README Document for

AIRS Level-2 Version 5 Support Products:

AIRH2SUP	(AIRS, AMSU & HSB)
AIRX2SUP, AIRX2SUP_NRT	(AIRS & AMSU)
AIRS2SUP	(AIRS only)

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Revision History

Revision Date	***Changes***	***Author***
4/25/2008	Initial version	Young-In Won
7/21/2009	Removed reference to retired WHOM search engine	Randy Barth

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1. Introduction

1.1 Brief background

This document applies to the Atmospheric Infrared Sounder (AIRS) **Version 5 Level-2 Support products (including Near Real Time product)** which includes higher vertical resolution profiles of the quantities found in the Standard Retrieval Product, plus intermediate output, research products such as the abundance of trace gases, and detailed quality assessment information. The Support Product profiles contain 100 levels between 1100 and .016 mb; this higher resolution will simplify the generation of radiances using forward models, though the vertical information content is no greater than in the Standard Product profiles. The L2 Support Product is intended for the knowledgeable, experienced user of AIRS products and is **not intended for general users**. The Support Product is generated at all locations as Standard Products.

There are three types of **Support Products** (see section 2.2 for further details): retrieval products using AIRS IR, AMSU, and HSB (**AIRH2SUP),** using AIRS IR and AMSU **(AIRX2SUP)** and AIRS IR only **(AIRS2SUP)**. The **AIRX2SUP_NRT (Near Real Time)** product is also available within ~3 hours of observations globally and stay for about 5 days from the time they are generated.

From 705.3 km altitude, an Advanced Microwave Sounding Unit (AMSU-A) footprint at nadir is about 45 km in diameter. It contains 3×3 AIRS IR observations (each is about 13.5 km) as depicted in Figure 1. Retrievals are performed inside AMSU-A footprints. Therefore, the final retrieval results have a horizontal resolution of 45 km.

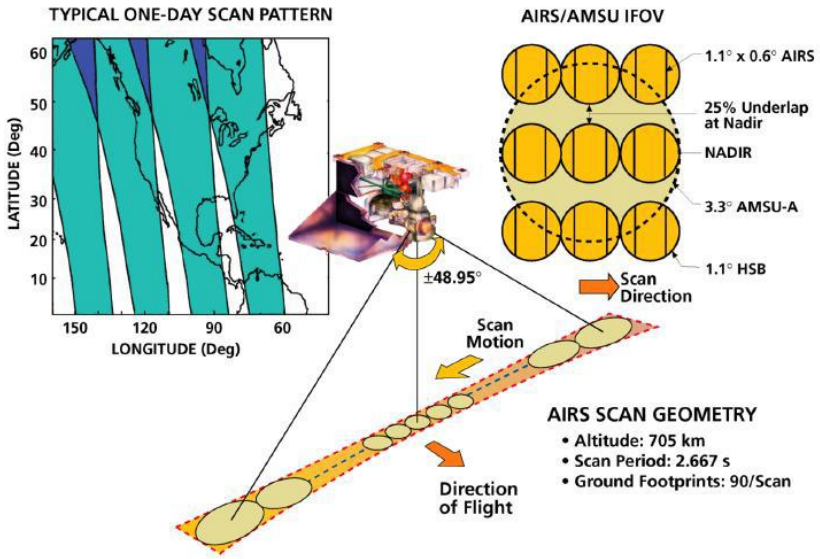


Figure 1. AIRS scan geometry

Table 1. Basic characteristics of the AIR Support Product

Latitude Range	-90° to 90°N
Longitude extent	-180° to 180°E
horizontal resolution	45 km (~0.5 degree)
Temporal resolution	6 minutes

1.2 Significant changes from V4 to V5

We strongly encourage users to use V5 products rather than V4 (GES DISC Collection 3 data products). A short description on changes from V4 to V5 that are most visible to the user is given below.

Improved Quality Indicators and Error Estimates
In the V5 release, an improved set of quality indicators has been provided to inform the user separately about the quality of the retrieval of various products. Please read the Level 2 Quality Control and Error Estimation documentation for a description of these indicators and how they are set.
V5_L2_Quality_Control_and_Error_Estimation.pdf

The V5 temperature profile yield is increased and the error estimate improved. The greatest yield increase is in the polar regions, and the greatest improvement in quality is over land. The yield in moisture retrievals has decreased slightly, but the quality of the accepted retrieval has increased, their error estimates improved and there are fewer outliers. In particular, there are no longer anomalously high moisture retrievals over warm scenes and the upper tropospheric dry bias and total water vapor wet bias have both improved over V4.

Correction to Saturation and Relative Humidity
The layer-average vapor pressure saturation relation for water vapor is provided over liquid and over liquid/ice dependent upon air temperature. The relative humidity calculation error present in V4 has been corrected.

Correction to Outgoing Longwave Radiation
The OLR calculation error present in V4 has been corrected. There was no error in the calculation for clear-sky OLR (clrolr) in V4.

Improved O_3 Product
The V5 ozone retrieval channel set has been refined and an observationally based climatology is used for a first guess rather than a regression. The result is that the V5 ozone retrievals are less biased in the mid to low troposphere.

Addition of CO and CH_4 Products

V5 L2 products now include total burden and profiles for carbon monoxide and methane. V5 L3 products contain profiles for both carbon monoxide and methane along with total column carbon monoxide. The methane product is an unvalidated research product that is still being refined.

Averaging Kernel, Verticality and Degrees of Freedom
V5 L2 products now provide averaging kernel (in support product), verticality and degrees of freedom for moisture, ozone, carbon monoxide and methane profiles.

AMSU-A Level 1B Sidelobe Correction Implemented
V5 AMSU-A L1B products now provide a sidelobe-correct brightness temperature in addition to the antenna temperature. The temperature error calculation is now fully implemented.

no HSB and including HSB
The HSB instrument ceased operation on February 5, 2003 due to a mirror motor failure. Released V5 of AIRS Data Products provide two versions of the L2 and L3 data products up to the date of HSB failure, and a single version thereafter.
See **V5_Released_Proc_FileDesc.pdf**
for a complete description of the AIRS Data Product file name and local granule ID (LGID) convention.

Removal of VIS/NIR Derived Cloud Fields
The Visible/Near Infrared derived cloud fields have been removed in V5.

Preparation of AIRS-Only Processing Option
We have prepared an AIRS-Only processing option whose products become visible to users due to a degrade of AMSU channel.

A complete listing of the noteworthy changes from V4 to V5 is provided in the document:
V5_Changes_from_V4.pdf

1.3 AIRS Instrument Description

The Atmospheric Infrared Sounder (AIRS) instrument suite is designed to measure the Earth's atmospheric water vapor and temperature profiles on a global scale. It is comprised of a space-based hyperspectral infrared instrument (AIRS) and two multichannel microwave instruments, the Advanced Microwave Sounding Unit (AMSU-A) and the Humidity Sounder for Brazil (HSB). The AIRS instrument suite is one of several instruments onboard the Earth Observing System (EOS) Aqua spacecraft launched May 4, 2002. The HSB instrument ceased operation on February 5, 2003.

1.3.1 AIRS

AIRS is a high spectral resolution spectrometer on board Aqua satellite with 2378 bands in the thermal infrared (3.7 - 15.4 μm) and 4 bands in the visible (0.4 - 1.0 μm). These ranges have been specifically selected to allow determination of atmospheric temperature with an accuracy of 1°C in layers 1 km thick, and humidity with an accuracy of 20% in layers 2 km thick in the troposphere. In the cross-track direction, a ±49.5 degree swath centered on the nadir is scanned

in 2 seconds, followed by a rapid scan in 2/3 second taking routine calibration related data that consist of four independent Cold Space Views, one view of the Onboard Blackbody Calibrator, one view of the Onboard Spectral Reference Source, and one view of a photometric calibrator for the VIS/NIR photometer. Each scan line contains 90 IR footprints, with a resolution of 13.5 km at nadir and 41km x 21.4 km at the scan extremes from nominal 705.3 km orbit. The Vis/NIR spatial resolution is approximately 2.3 km at nadir.

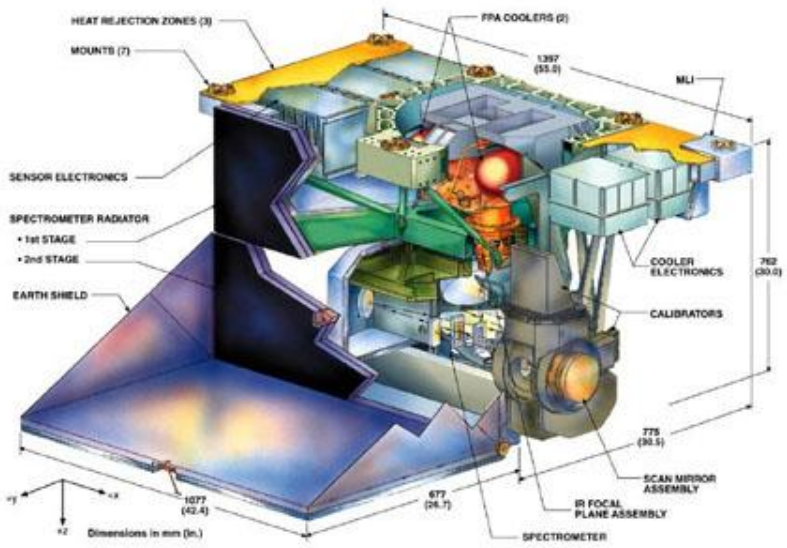


Figure 2. AIRS instrument cutaway drawing.

The primary spectral calibration of the AIRS spectrometer is based on the cross-correlation between spectral features observed in the upwelling radiance spectrum with precalculated spectra. And additional spectral reference source is provided to aid pre-launch testing in the thermal vacuum chamber during spacecraft integration and for quality monitoring in orbit.

Table 2. Technology - Specifications

Instrument Type	Multi-aperture, non-Littrow echelle array grating spectrometer.
Infrared Spectral Coverage	3.74 - 4.61 μm 6.20 - 8.22 μm 8.80 - 15.4 μm
Spectral Response	$\lambda/\Delta\lambda > 1200$ nominal
Spectral Resolution	$\Delta\lambda/2$
Spectral Sampling	$\pm 1\ \Delta\lambda$
Integrated Response (95%)	$0.05\ \Delta\lambda$ 24 hours
Wavelength Stability	$0.01\ \Delta\lambda$
Scan Angle	±49.5° around nadir

Swath Width	1650 km nominal
Instantaneous Field of View (IFOV)	1.1°
Measurement Simultaneity	>99%
Sensitivity (NEDT)	0.14 K at 4.2 μm 0.20 K from 3.7 - 13.6 μm 0.35 K from 13.6 - 15.4 μm
Radiometric Calibration	±3% absolute error

1.3.2 AMSU-A

AMSU-A primarily provides temperature soundings. It is a 15-channel microwave temperature sounder implemented as two independently operated modules. Module 1 (AMSU-A1) has 12 channels in the 50-58 GHz oxygen absorption band which provide the primary temperature sounding capabilities and 1 channel at 89 GHz which provides surface and moisture information. Module 2 (AMSU-A2) has 2 channels: one at 23.8 GHz and one at 31.4 GHz which provide surface and moisture information (total precipitable water and cloud liquid water). Like AIRS, AMSU-A is a cross-track scanner. The three receiving antennas, two for AMSU-A1 and one for AMSU-A2, are parabolic focusing reflectors that are mounted on a scan axis at a 45° Tilt angle, so that radiation is reflected from a direction along the scan axis (a 90° reflection). AMSU-A scans three times as slowly as AIRS (once per 8 seconds) and its footprints are approximately three times as large as those of AIRS (45 km at nadir). This result in three AIRS scans per AMSU-A scans and nine AIRS footprints per AMSU-A footprint.

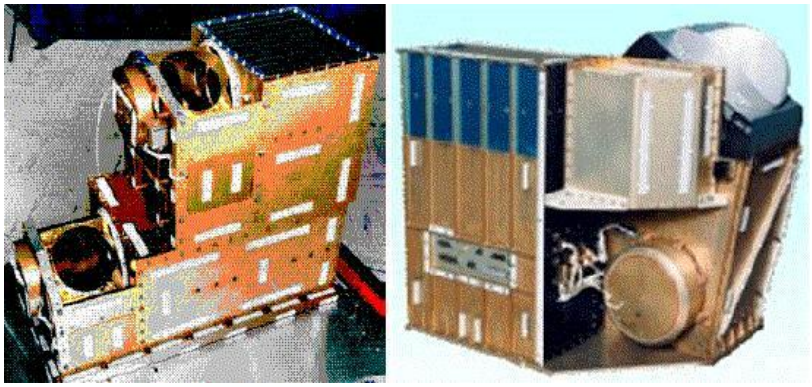


Figure 3. View of AMSU-A1 (left) and AMSU-A2 right.

Table 3. AMSU instrument characteristics

	AMSU-A1	AMSU-A2
Data Rate	1.3 kbits/s	0.5 kbits/s
Antenna Size	15 cm (2 units)	31 cm (1unit)

Instantaneous Field of View (IFOV)	3.3°	3.3°
Swath Width	100; 1650 km	100; 1650 km
Pointing Accuracy	± 0.2°	± 0.2°
Number of Channels	13	2

Sensor	Channel	Central Frequency (GHz)	Bandwidth (MHz)	Sensitivity NEDT (K)
AMSU-A2	1	23.8	270	0.3
	2	31.4	180	0.3
AMSU-A1	1	50.300	180	0.4
	2	52.800	400	0.25
	3	53.596±0.115	170	0.25
	4	54.400	400	0.25
	5	54.940	400	0.25
	6	55.500	330	0.25
	7	57.290344 = Flo	330	0.25
	8	Flo±0.217	78	0.4
	9	Flo±0.3222 (±0.048)	36	0.4
	10	Flo±0.3222 (±0.022)	16	0.6
	11	Flo±0.3222 (±0.010)	8	0.8
	12	Flo±0.3222 (±0.0045)	3	1.2
	13	89.000	6000	0.5

1.3.3 HSB

The Humidity Sounder for Brazil (HSB) is primarily a humidity sounder providing supplementary water vapor and liquid data to be used in the cloud clearing process. The HSB is a 4-channel microwave moisture sounder implemented as a single module. Three channels are located near 183 GHz, while the fourth is a window channel at 150 GHz. Physically HSB is identical to AMSU-B, which is operated by NOAA on its most recent POES satellites, but HSB lacks the fifth channel (89 GHz) of AMSU-B. Like AMSU-B, it samples ninety 1.1 ° scenes per 2.67-second crosstrack scan. Due to the higher spatial resolution (which equals that of AIRS) and a higher scan rate, the measurement density is 2.4 times that of AMSU-A (20 % less than for AMSU-B). HSB is very similar to AMSU-A, except that is contains only one antenna/receiver system. Its scan speed as well as its footprints is similar to AIRS (three scans per 8 seconds and about 15 km at nadir, respectively). There is therefore one HSB footprint per AIRS footprint.

The HSB is the object of a scientific and technical cooperation agreement between NASA and AEB (Agencia Espacial Brasileira), Brazilian Space Agency. The HSB instrument ceased operation on February 5, 2003 due to a mirror scan motor failure.

Table 4. HSB instrument characteristics

		HSB
Data Rate		4.2 kbps
Antenna Size		21.9 cm diameter
Instantaneous Field of View (IFOV)		1.1° degree circular
Swath Width		1650 km
Number of Channels		4
Channel Number	Central Frequency (GHz)	Bandwidth (MHz)
1*	Deleted (89GHz)	
2	150.0	4000
3	183.31 ± 1.0	2x500
4	183.31 ± 3.0	2x1000
5	183.31 ± 7.0	2x2000

1.4 Brief background on algorithm

Level 2 produces 240 granules (see section 2.1) of each of the following AIRS products:

Data Set	Short Name	Granule Size
L2 Cloud-cleared radiances	AIRH2CCF AIRI2CCF AIRS2CCF	10 MB
L2 Standard Product	AIRX2RET	5.4 MB
L2 Support Product	**AIRH2SUP** **AIRX2SUP** **AIRS2SUP** **AIRX2SUP_NRT**	**14 MB**

Each granule contains the data fields from 1350 retrievals laid out in an array of dimension 30x45, corresponding to the 30 AMSU footprints (cross-track) in each of 45 scansets (along-track).

Level 2 AIRX2SUP_NRT products are produced by the same core science algorithms as in the regular science data production, but using predicted ephemeris in place of definitive ephemeris data. The advantage of NRT data is its fast turnaround time, generally available within 3 hours of observations globally. They can be utilized in regional weather forecast models as well as in support of field campaigns.

Please refer to the Advanced Theoretical Basis Document (ATBD) for AIRS Level-2 products, AIRS-TEAM RETRIEVAL FOR CORE PRODUCTS AND GEOPHYSICAL PARAMETERS. Here is the table of contents:

1.5 Data Disclaimer

AIRS science team provides AIRS/AMSU/HSB Version 5 Data Disclaimer document as a part of Version 005 data release, here is the table of contents:

2. Data Organization

2.1 Granularity

The continuous AIRS data is broken into a series of 6-minute segments. Each segment (granule) is a file. Over the course of 6 minutes the EOS Aqua platform travels approximately 1500 km, and the AIRS-suite instruments scan (whisk broom) a swath approximately 1500 km wide.

Start times of granules are keyed to the start of 1958. Because of leap seconds, they do not start at the same time as days do. For data from launch through 12-31-2005, granule 1 spans 00:05:26Z - 00:11:26Z and granule 240 starts at 23:59:26Z and ends at 00:05:26Z the next day. For data 12-31-2005 through the next leap second, granule 1 spans 00:05:25Z - 00:11:25Z and granule 240 starts at 23:59:25Z and ends at 00:05:25Z the next day.

2.2 File naming convention

There exist two versions of the Level 2 Support Product files before February 5, 2003. On that date, the Humidity Sounder for Brazil (HSB) failed. The retrieval algorithm was adjusted to allow operation with and without ingesting HSB radiances. Retrievals for the period before February 5, 2003 are carried out with and without HSB. The AIRS Level 2 Support Product granules resulting from including HSB radiances have shortname "**AIRH2SUP**" and their file names incorporate this character string. Granules resulting from not ingesting HSB radiances have shortname "**AIRX2SUP**" and their file names incorporate this character string. This latter set carries through after February 5, 2003 to the current date and is the bulk of the AIRS Level 2 product. It is produced for the period before HSB failed so that a consistent product exists for the entire period of the operation of AIRS. More recently, new products resulting from AIRS IR only are added with shortname "**AIRS2SUP**". The new products are produced since the radiometric noise in AMSU channel 4 started to increase significantly (since May 2007).

The AIRS Level-2 Support Product files are named in accordance to the following convention:

AIRS.*yyyy***.***mm***.***dd***.***ggg***.L2.RetSup_H.v***m.m.r.b***.***productionTimeStamp***.hdf (AIRH2SUP)**
AIRS.*yyyy***.***mm***.***dd***.***ggg***.L2.RetSup.v***m.m.r.b***.***productionTimeStamp***.hdf(AIRX2SUP,AIRX2SUP_NRT)**
AIRS.*yyyy***.***mm***.***dd***.***ggg***.L2.RetSup_IR.v***m.m.r.b***.***productionTimeStamp***.hdf (AIRS2SUP)**

For example: AIRS.2007.01.01.001.L2.RetSup.v5.0.14.0.G07193140737.hdf

Where:

- **yyyy** = 4 digit year number [2002 -].
- **mm** = 2 digit month number [01-12]
- **dd** = day of month [01-31]
- **ggg** = granule number [1-240]
- **L2** = Level 2
- **RetSup =** string defining the product file type (support product)
- **vm.m.r.b** = algorithm version identifier is made up of major version, minor version, release version and build number respectively.

- **productionTimeStamp** = file creation time stamp. Starts off with a letter
  G for GES DISC processing facility
  R for AIRX2SUP_NRT product
  followed by yydddhhmmss.
  - yy: year number without century;
  - ddd: day of a year [1-366];
  - hhmmss: hours, minutes and seconds UTC time.
- **hdf** = format of the file.

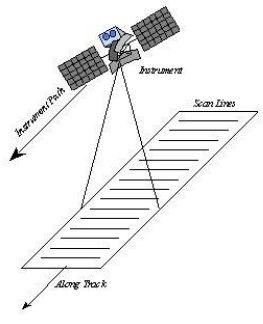
2.3 File Format

AIRS Level-2 files (including **AIRH2SUP, AIRX2SUP, AIRS2SUP**) are stored in the Hierarchical Data Format-Earth Observing System (HDF-EOS4) Swath format. HDF-EOS4 format is an extension of the HDF4 format (developed by NCSA) to meet the needs of EOS data products

HDF: The following website contains detailed information on HDF file format, http://hdf.ncsa.uiuc.edu/. HDFView, one of visual tool for browsing and editing NCSA HDF4 and HDF5 files would be of great help in viewing, creating, or modifying the contents of a dataset.

HDF-EOS: In 1993 NASA chose NCSA's HDF format to be the standard file format for storing data from the Earth Observing System (EOS), which is the data gathering system of sensors (mainly satellites) supporting the Global Climate Change Research Program. Since NASA's selection of HDF, NCSA (and now THG) has been working with NASA to prepare for the enormous data management challenges that will come when the system is fully functional. This has included the development of a specialized form of HDF called HDF-EOS, which deals specifically with the kinds of data that EOS produces.

Swath: The swath concept for HDF-EOS is based on a typical satellite swath, where an instrument takes a series of scans perpendicular to the ground track of the satellite as it moves along that ground track (see Diagram on the right). As the AIRS is profiling instrument that scans across the ground track, the data would be a three dimensional array of measurements where two of the dimensions correspond to the standard scanning dimensions (along the ground track and across the ground track), and the third dimension represents a range from the sensor. The "horizontal" dimensions can be handled as normal geographic dimensions, while the third dimensions can be handled as a special "vertical" dimension.



2.4 Data Structure inside File

An AIRS Level-2 support product file is made of four major groups; “Dimensions”, “geolocation fields”, “Attributes”, and “Data fields” with data fields sub-divided into “Per-Granule Data Fields”, "Along-Track Data Fields, and “Full Swath Data Fields”.

Dimensions: These are HDF-EOS swath dimensions. The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "GeoTrack" is understood to be the dimension along the path of the spacecraft, and "GeoXTrack" is the dimension across the spacecraft track, starting on the left looking forward along the spacecraft track. There may also be a second across-track dimension "CalXTrack," equivalent to "GeoXTrack," except that "CalXTrack" refers to the number of calibration footprints per scanline. "GeoTrack" is 45 for large-spot products (AMSU-A, Level-2, cloud-cleared AIRS) and 135 for small-spot products (AIRS, Vis/NIR, HSB).

geolocation fields: These are all 64-bit floating-point fields that give the location of the data in space and time. If the note before the table specifies that these fields appear once per scanline then they have the single dimension "GeoTrack." Otherwise, they appear once per footprint per scanline and have dimensions "GeoTrack,GeoXTrack."

Attributes: These are scalar or string fields that appear only once per granule. They are attributes in the HDF-EOS Swath sense.

Per-Granule Data Fields: These are fields that are valid for the entire granule but that are not scalars because they have some additional dimension.

Along-Track Data Fields: These are fields that occur once for every scanline. These fields have dimension "GeoTrack" before any "Extra Dimensions." So an "Along-Track Data Field" with "Extra Dimensions" of "None" has dimensions "GeoTrack"; whereas, if the "Extra Dimensions" is "SpaceXTrack (= 4)," then it has dimensions "GeoTrack,SpaceXTrack."

Full Swath Data Fields: These are fields that occur once for every footprint of every scanline. These have dimensions "GeoTrack,GeoXTrack" before any "Extra Dimensions." So a "Full Swath Data Field" with "Extra Dimensions" of "None" has dimensions "GeoTrack,GeoXTrack"; whereas, if the "Extra Dimensions" is "Channel (= 2378)," then it has dimensions "GeoTrack,GeoXTrack,Channel."

Special AIRS Types: These special AIRS types are used as "shorthand" for groups of fields, listed in the "Attributes," "Along-Track Data Fields" and "Full Swath Data Fields" tables as single fields. If the name of a special AIRS type appears in the "Type" column of one of these tables in place of a standard type, then there are really as many fields as there are rows in the corresponding type table, each with a name made up of the "Name" from the upper table followed by a "." and the "Field Name" from the lower table.

2.5 Key data fields (see the following section for a complete list)

The data fields most likely to be used by users are as follows.

geolocation Fields:

- Latitude
  FOV boresight geodetic latitude (degrees North, -90->+90), dimension (30,45)
- Longitude
  FOV boresight geodetic longitude (degrees East, -180->+180), dimension (30,45)

Per-Granule Data Fields:

- pressSupp
  support pressure (mb) for each of 100 levels in atmosphere associated with temperature, moisture and ozone profiles. **The array order is from the top of atmosphere downward**. This is the reverse of **pressStd** ordering. Note that topography may place some of these levels below the surface, dimension (100)

Swath Data Fields:

- PsurfStd
  first guess surface pressure, interpolated from forecast and mean topography of FOV (mb), dimension (30,45)
- nSurfSup
  index of first pressure level above the mean surface (90, …, 100), dimension (30,45)
- TAirSup
  retrieved atmospheric temperature profile (K) at the **pressSupp** pressures. Array values below the surface (index < **nSurfStd**) are not physically meaningful. In particular, the first level below the surface contains an extrapolated value. Always check nSurfSup to identify where extrapolated values begin. The surface value (at **PsurfStd)** must be calculated by interpolating in the log(pressure) domain between this value and the value in the next level up (index = **nSurfSup**-1), dimension (100,30,45)
- TAirMWOnly
  MW-only retrieved atmospheric temperature profile (K), dimension (100,30,45)
- H2OCDSup
  Retrieved layer column water vapor (molecules/cm-2). The layer corresponding to value H2OCDSup(index) is bounded by pressSupp(index) at the bottom and pressSupp(index-1) at the top. Array values below the surface (index < nSurfStd) are not physically meaningful. In particular, the first level below the surface contains an extrapolated value. Always check nSurfSup to identify where extrapolated values begin. The surface value (at PsurfStd) must be calculated by interpolating in the log(pressure) domain between this value and the value in the next level up (index = nSurfSup-1), dimension (100,30,45)
- H2OCDMWOnly
  layer-averaged MW-only retrieved column water vapor, dimension (100,30,45)
- lwCDSup
  Retrieved layer column cloud liquid water (molecules/cm-2). The layer corresponding to value **lwCDSup**(index) is bounded by **pressSupp**(index) at the bottom and **pressSupp**(index-1) at the top. Array values below the surface (index < **nSurfStd**) are not physically meaningful. In particular, the first level below the surface contains an extrapolated value. Always check **nSurfSup** to identify where extrapolated values begin. The surface value (at **PsurfStd**) must be calculated by

interpolating in the log(pressure) domain between this value and the value in the next level up (index = **nSurfSup**-1), dimension (100,30,45)

- O3CDSup

  Retrieved layer column ozone (molecules/cm-2). The layer corresponding to value **O3CDSup**(index) is bounded by **pressSupp**(index) at the bottom and **pressSupp**(index-1) at the top. Array values below the surface (index < **nSurfStd)** are not physically meaningful. In particular, the first level below the surface contains an extrapolated value. Always check **nSurfSup** to identify where extrapolated values begin. The surface value (at **PsurfStd**) must be calculated by interpolating in the log(pressure) domain between this value and the value in the next level up (index = **nSurfSup**-1), dimension (100,30,45)

3. Data Contents

3.1 Dimensions

These fields define all dimensions that can be used for HDF-EOS swath fields.

The names "GeoTrack" and "GeoXTrack" have a special meaning for this document: "Cross-Track" data fields have a hidden dimension of "GeoXTrack"; "Along-Track" data fields have a hidden dimension of "GeoTrack"; "Full Swath" data fields have hidden dimensions of both "GeoTrack" and "GeoXTrack".

Name	Value	Explanation
GeoXTrack	30	Dimension across track for footprint positions. Same as number of footprints per scanline. -- starting at the left and increasing towards the right as you look along the satellite's path
GeoTrack	# of scan lines in swath	Dimension along track for footprint positions. Same as number of scanlines in granule. Parallel to the satellite's path, increasing with time. (Nominally 45 for Level-2, AMSU-A, and AIRS/Vis low-rate engineering; 135 for AIRS/Vis and HSB high-rate quantities)
StdPressureLev	28	Number of standard pressure altitude levels (from bottom of the atmosphere up); nSurfStd is the 1-based index of the first valid level for a given profile. Any levels before this are below the surface. Since the actual surface will not be be exactly at this level, it will be necessary to extrapolate or interpolate to get precise surface values. See entries for specific fields for more details.
StdPressureLay	28	Number of standard pressure altitude layers (Always equal to StdPressureLev: last layer goes to the top of the atmosphere); nSurfStd is the 1-based index of the first valid layer for a given profile. Any layers before this are below the surface. Since the actual surface will not be be exactly at the bottom of this layer, it will be necessary to extrapolate or interpolate to get total amounts for surface layers. See entries for specific fields for more details.
AIRSXTrack	3	The number of AIRS cross-track spots per AMSU-A spot. Direction is the same as GeoXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
AIRSTrack	3	The number of AIRS along-track spots per AMSU-A spot. Direction is the same as GeoTrack -- parallel to the satellite's path, increasing with time
Cloud	2	Cloud layer dimension in order of increasing pressure. Only first numCloud elements are valid
ChanAMSUA	15	Dimension of AMSU-A Channel array (Channel 1: 23.8 GHz; Ch 2: 31.4 GHz; Ch 3: 50.3 GHz; Ch 4: 52.8 GHz; Ch 5: 53.596 +/- 0.115 GHz; Ch 6: 54.4 GHz; Ch 7: 54.94 GHz; Ch 8: 55.5 GHz; Ch 9: f0; Ch 10: f0 +/- 0.217 GHz Ch 11: f0 +/- df +/- 48 MHz; Ch 12: f0 +/- df +/- 22 MHz; Ch 13: f0 +/- df +/- 10 MHz; Ch 14: f0 +/- df +/- 4.5 MHz; Ch 15: 89 GHz (f0 = 57290.344 MHz; df = 322.4 MHz))
ChanHSB	5	Dimension of HSB Channel array (Channel 1: Deleted 89.0 GHz channel: always invalid; Ch 2: 150.0 GHz; Ch 3: f0 +/- 1.0 GHz; Ch 4: f0 +/- 3.0 GHz; Ch 5: f0 +/- 7.0 GHz (f0 = 183.31 GHz))
MWHingeSurf	7	Number of standard frequency hinge points in Microwave surface emissivity and surface brightness. Frequencies are 23.8, 31.4, 50.3, 52.8, 89.0, 150.0, 183.31 GHz respectively.Values are also found in field MWHingeSurfFreqGHz.
H2OFunc	11	Functions on which water vapor retrieval is calculated
O3Func	9	Functions on which ozone retrieval is calculated
COFunc	9	Functions on which carbon monoxide retrieval is calculated

CH4Func	7	Functions on which methane retrieval is calculated
HingeSurf	100	Maximum number of frequency hinge points in IR surface emissivity
XtraPressureLev	100	Number of pressure altitude layers in high vertical resolution support products (from top of the atmosphere down); nSurfSup is the 1-based index of the last valid level for a given profile. Any levels beyond this are below the surface. Since the actual surface will not be be exactly at this level, it will be necessary to extrapolate or interpolate to get precise surface values. See entries for specific fields for more details.
XtraPressureLay	100	Number of pressure altitude layers in high vertical resolution support products (Always equal to XtraressureLev: first layer goes from the top of the atmosphere to level 1); nSurfSup is the 1-based index of the last valid layer for a given profile. Any layers beyond this are below the surface. Since the actual surface will not be be exactly at the bottom of this layer, it will be necessary to extrapolate or interpolate to get total amounts for surface layers. See entries for specific fields for more details.
HingeCloud	7	Frequency hinge points in cloud emissivity in order of increasing frequency. Only first numHingeCloud elements are valid
HingeSurfInit	50	Maximum number of frequency hinge points in IR surface emissivity from initial regression
VisXTrack	8	The number of Vis cross-track spots per AIRS. Direction is the same as GeoXTrack & AIRSXTrack -- starting at the left and increasing towards the right as you look along the satellite's path
VisTrack	9	The number of Vis along-track spots per AIRS. Direction is the same as GeoTrack & AIRSTrack -- parallel to the satellite's path, increasing with time. (opposite order to detector ordering -- detector 0 is last)
VChn	4	The number of Visible channels
ScoresBand	10	The number of IR frequency bands for which Initial_CC_subscores are calculated. Band limits are (in cm^-1): 645., 704., 800., 1000., 1200., 2200., 2304., 2382., 2390., 2400., 2600.
CCTest	10	The number of cloud-clearing tests
VisGeoSpots	4	Geolocations for the 4 corner pixels in the order: trailing first scanned; trailing last-scanned; leading first-scanned; leading last-scanned. Each footprint also has a central geolocation associated with the swath geolocation lat/lon/time of the footprint.
MODISEmisBand	6	MODIS bands for IR emissivity first guess: 833.33, 909.09, 1169.6, 2469.1, 2531.6, and 2666.7 cm**-1.
TempFunc	23	Functions on which temperature retrieval is calculated

3.2 Geolocation Fields

These fields appear for every footprint (GeoTrack * GeoXTrack times) and correspond to footprint center coordinates and "shutter" time.

Name	Explanation
Latitude	Footprint boresight geodetic Latitude in degrees North (-90.0 ... 90.0)
Longitude	Footprint boresight geodetic Longitude in degrees East (-180.0 ... 180.0)
Time	Footprint "shutter" TAI Time: floating-point elapsed seconds since Jan 1, 1993

3.3 Attributes

These fields appear only once per granule and use the HDF-EOS "Attribute" interface.

Name	Type	Explanation

NumSO2FOVs	16-bit unsigned integer	Number of fields-of-view (out of a nominal 1350) with a signifcant SO2 concentration based on the value of BT_diff_SO2.
processing_level	string of 8-bit characters	Zero-terminated character string denoting processing level ("Level2")
instrument	string of 8-bit characters	Zero-terminated character string denoting instrument ("AIRS")
DayNightFlag	string of 8-bit characters	Zero-terminated character string set to "Night" when the subsatellite points at the beginning and end of a granule are both experiencing night according to the "civil twilight" standard (center of refracted sun is below the horizon). It is set to "Day" when both are experiencing day, and "Both" when one is experiencing day and the other night. "NA" is used when a determination cannot be made.
AutomaticQAFlag	string of 8-bit characters	Zero-terminated character string denoting granule data quality: (Always "Passed", "Failed", or "Suspect")
NumTotalData	32-bit integer	Total number of expected scene footprints
NumProcessData	32-bit integer	Number of scene footprints which are present and can be processed routinely (state = 0)
NumSpecialData	32-bit integer	Number of scene footprints which are present and can be processed only as a special test (state = 1)
NumBadData	32-bit integer	Number of scene footprints which are present but cannot be processed (state = 2)
NumMissingData	32-bit integer	Number of expected scene footprints which are not present (state = 3)
NumLandSurface	32-bit integer	Number of scene footprints for which the surface is more than 90% land
NumOceanSurface	32-bit integer	Number of scene footprints for which the surface is less than 10% land
node_type	string of 8-bit characters	Zero-terminated character string denoting whether granule is ascending, descending, or pole-crossing: ("Ascending" and "Descending" for entirely ascending or entirely descending granules, or "NorthPole" or "SouthPole" for pole-crossing granules. "NA" when determination cannot be made.)
start_year	32-bit integer	Year in which granule started, UTC (e.g. 1999)
start_month	32-bit integer	Month in which granule started, UTC (1 ... 12)
start_day	32-bit integer	Day of month in which granule started, UTC (1 ... 31)
start_hour	32-bit integer	Hour of day in which granule started, UTC (0 ... 23)
start_minute	32-bit integer	Minute of hour in which granule started, UTC (0 ... 59)
start_sec	32-bit floating-point	Second of minute in which granule started, UTC (0.0 ... 59.0)
start_orbit	32-bit integer	Orbit number of mission in which granule started
end_orbit	32-bit integer	Orbit number of mission in which granule ended
orbit_path	32-bit integer	Orbit path of start orbit (1 ... 233 as defined by EOS project)
start_orbit_row	32-bit integer	Orbit row at start of granule (1 ... 248 as defined by EOS project)
end_orbit_row	32-bit integer	Orbit row at end of granule (1 ... 248 as defined by EOS project)

granule_number	32-bit integer	Number of granule within day (1 ... 240)
num_scansets	32-bit integer	Number of scansets in granule (1 ... 45)
num_scanlines	32-bit integer	Number of scanlines in granule (1 * num_scansets)
start_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees North (-90.0 ... 90.0)
start_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at start of granule (subsatellite location at midpoint of first scan) in degrees East (-180.0 ... 180.0)
start_Time	64-bit floating-point	TAI Time at start of granule (floating-point elapsed seconds since start of 1993)
end_Latitude	64-bit floating-point	Geodetic Latitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees North (-90.0 ... 90.0)
end_Longitude	64-bit floating-point	Geodetic Longitude of spacecraft at end of granule (subsatellite location at midpoint of last scan) in degrees East (-180.0 ... 180.0)
end_Time	64-bit floating-point	TAI Time at end of granule (floating-point elapsed seconds since start of 1993)
eq_x_longitude	32-bit floating-point	Longitude of spacecraft at southward equator crossing nearest granule start in degrees East (-180.0 ... 180.0)
eq_x_tai	64-bit floating-point	Time of eq_x_longitude in TAI units (floating-point elapsed seconds since start of 1993)
orbitgeoqa	32-bit unsigned integer	Orbit Geolocation QA:; Bit 0: (LSB, value 1) bad input value (last scanline); Bit 1: (value 2) bad input value (first scanline); Bit 2: (value 4) PGS_EPH_GetEphMet() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 3: (value 8) PGS_EPH_GetEphMet() gave PGSEPH_E_BAD_ARRAY_SIZE; Bit 4: (value 16) PGS_EPH_GetEphMet() gave PGSTD_E_TIME_FMT_ERROR; Bit 5: (value 32) PGS_EPH_GetEphMet() gave PGSTD_E_TIME_VALUE_ERROR; Bit 6: (value 64) PGS_EPH_GetEphMet() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 7: (value 128) PGS_EPH_GetEphMet() gave PGS_E_TOOLKIT; Bit 8: (value 256) PGS_TD_UTCtoTAI() gave PGSTD_E_NO_LEAP_SECS; Bit 9: (value 512) PGS_TD_UTCtoTAI() gave PGSTD_E_TIME_FMT_ERROR; Bit 10: (value 1024) PGS_TD_UTCtoTAI() gave PGSTD_E_TIME_VALUE_ERROR; Bit 11: (value 2048) PGS_TD_UTCtoTAI() gave PGS_E_TOOLKIT; Bit 12: (value 4096) PGS_CSC_DayNight() gave PGSTD_E_NO_LEAP_SECS; Bit 13: (value 8192) PGS_CSC_DayNight() gave PGSCSC_E_INVALID_LIMITTAG; Bit 14: (value 16384) PGS_CSC_DayNight() gave PGSCSC_E_BAD_ARRAY_SIZE; Bit 15: (value 32768) PGS_CSC_DayNight() gave PGSCSC_W_ERROR_IN_DAYNIGHT; Bit 16: (value 65536) PGS_CSC_DayNight() gave PGSCSC_W_BAD_TRANSFORM_VALUE; Bit 17: (value 131072) PGS_CSC_DayNight() gave PGSCSC_W_BELOW_HORIZON; Bit 18: (value 262144) PGS_CSC_DayNight() gave PGSCSC_W_PREDICTED_UT1 (This is expected except when reprocessing.); Bit 19: (value 524288) PGS_CSC_DayNight() gave PGSTD_E_NO_UT1_VALUE; Bit 20: (value 1048576) PGS_CSC_DayNight() gave PGSTD_E_BAD_INITIAL_TIME; Bit 21: (value 2097152) PGS_CSC_DayNight() gave PGSCBP_E_TIME_OUT_OF_RANGE; Bit 22: (value 4194304) PGS_CSC_DayNight() gave PGSCBP_E_UNABLE_TO_OPEN_FILE; Bit 23: (value 8388608) PGS_CSC_DayNight() gave PGSMEM_E_NO_MEMORY; Bit 24: (value 16777216) PGS_CSC_DayNight() gave PGS_E_TOOLKIT; Bit 25-31: not used
num_satgeoqa	16-bit integer	Number of scans with problems in satgeoqa
num_glintgeoqa	16-bit	Number of scans with problems in glintgeoqa

	integer	
num_moongeoqa	16-bit integer	Number of scans with problems in moongeoqa
num_ftptgeoqa	16-bit integer	Number of footprints with problems in ftptgeoqa
num_zengeoqa	16-bit integer	Number of footprints with problems in zengeoqa
num_demgeoqa	16-bit integer	Number of footprints with problems in demgeoqa
num_fpe	16-bit integer	Number of floating point errors
LonGranuleCen	16-bit integer	Geodetic Longitude of the center of the granule in degrees East (-180 ... 180)
LatGranuleCen	16-bit integer	Geodetic Latitude of the center of the granule in degrees North (-90 ... 90)
LocTimeGranuleCen	16-bit integer	Local solar time at the center of the granule in minutes past midnight (0 ... 1439)
nFOV_big_ang_adj	16-bit integer	The number of FOVs with nchan_big_ang_adj over 5
CO_first_guess	string of 8-bit characters	Name of CO First Guess source.
CH4_first_guess	string of 8-bit characters	Name of CH4 First Guess source.
numHingeSurfInit	32-bit integer	Number of IR hinge points for surface emissivity and reflectivity from initial regression
NumMWStratIrRetOnly	32-bit integer	Number of profiles in which the final product comes only from MW and stratospheric IR information (retrieval_types 20, 30, 40)
NumNoHSB	32-bit integer	Number of retrieval profiles for which no HSB input data is used
NumNoAMSUA	32-bit integer	Number of retrieval profiles for which no AMSU-A input data is used
NumNoAIRS	32-bit integer	Number of retrieval profiles for which no AIRS-IR input data is used
NumNoVis	32-bit integer	Number of retrieval profiles for which no AIRS-V/NIR input data is used
DCRCount	32-bit integer	Number of times a Direct Current Restore was executed for any module
PopCount	32-bit integer	Number of popcorn events within granule, i.e. number of times than an AIRS channel used in the Level 2 retrieval has suffered a sudden discontinuity in dark current
MoonInViewMWCount	32-bit integer	Number of scanlines in granule with the moon in a Microwave space view (approx)

3.4 Per-Granule Data Fields

These fields appear only once per granule and use the HDF-EOS "Field" interface.

Name	Type	Extra Dimensions	Explanation
pressSupp	32-bit floating-point	XtraPressureLev (= 100)	Support pressures (lower boundary) in mbar.
pressStd	32-bit floating-point	StdPressureLev (= 28)	Standard pressures in mbar (bottom of the atmosphere first)
MWHingeSurfFreqGHz	32-bit floating-point	MWHingeSurf (= 7)	Frequencies in GHz for MW surface parameters (SfcTbMWStd, EmisMWStd,...)

H2O_trapezoid_layers	32-bit integer	H2OFunc (= 11)	Layers on which the H2O variables are defined.
O3_trapezoid_layers	32-bit integer	O3Func (= 9)	Layers on which the O3 variables are defined.
CO_trapezoid_layers	32-bit integer	COFunc (= 9)	Layers on which the CO variables are defined.
CH4_trapezoid_layers	32-bit integer	CH4Func (= 7)	Layers on which the CH4 variables are defined.
freqEmisInit	32-bit floating-point	HingeSurfInit (= 50)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurfInit elements are valid)

3.5 Along-Track Data Fields

These fields appear once per scanline (GeoTrack times).

Name	Type	Extra Dimensions	Explanation
satheight	32-bit floating-point	None	Satellite altitude at nadirTAI in km above reference ellipsoid (e.g. 725.2)
satroll	32-bit floating-point	None	Satellite attitude roll angle at nadirTAI (-180.0 ... 180.0 angle about the +x (roll) ORB axis, +x axis is positively oriented in the direction of orbital flight completing an orthogonal triad with y and z.)
satpitch	32-bit floating-point	None	Satellite attitude pitch angle at nadirTAI (-180.0 ... 180.0 angle about +y (pitch) ORB axis. +y axis is oriented normal to the orbit plane with the positive sense opposite to that of the orbit's angular momentum vector H.)
satyaw	32-bit floating-point	None	Satellite attitude yaw angle at nadirTAI (-180.0 ... 180.0 angle about +z (yaw) axis. +z axis is positively oriented Earthward parallel to the satellite radius vector R from the spacecraft center of mass to the center of the Earth.)
satgeoqa	32-bit unsigned integer	None	Satellite Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) PGS_TD_TAItoUTC() gave PGSTD_E_NO_LEAP_SECS; Bit 2: (value 4) PGS_TD_TAItoUTC() gave PGS_E_TOOLKIT; Bit 3: (value 8) PGS_EPH_EphemAttit() gave PGSEPH_W_BAD_EPHEM_VALUE; Bit 4: (value 16) PGS_EPH_EphemAttit() gave PGSEPH_E_BAD_EPHEM_FILE_HDR; Bit 5: (value 32) PGS_EPH_EphemAttit() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 6: (value 64) PGS_EPH_EphemAttit() gave PGSEPH_E_NO_DATA_REQUESTED; Bit 7: (value 128) PGS_EPH_EphemAttit() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 8: (value 256) PGS_EPH_EphemAttit() gave PGSEPH_E_BAD_ARRAY_SIZE; Bit 9: (value 512) PGS_EPH_EphemAttit() gave PGSTD_E_TIME_FMT_ERROR; Bit 10: (value 1024) PGS_EPH_EphemAttit() gave PGSTD_E_TIME_VALUE_ERROR; Bit 11: (value 2048) PGS_EPH_EphemAttit() gave PGSTD_E_NO_LEAP_SECS; Bit 12: (value 4096) PGS_EPH_EphemAttit() gave PGS_E_TOOLKIT; Bit 13: (value 8192) PGS_CSC_ECItoECR() gave PGSCSC_W_BAD_TRANSFORM_VALUE; Bit 14: (value 16384) PGS_CSC_ECItoECR() gave PGSCSC_E_BAD_ARRAY_SIZE; Bit 15: (value 32768) PGS_CSC_ECItoECR() gave PGSTD_E_NO_LEAP_SECS; Bit 16: (value 65536) PGS_CSC_ECItoECR() gave PGSTD_E_TIME_FMT_ERROR; Bit 17: (value 131072) PGS_CSC_ECItoECR() gave PGSTD_E_TIME_VALUE_ERROR; Bit 18: unused (set to zero); Bit 19: (value 524288) PGS_CSC_ECItoECR() gave PGSTD_E_NO_UT1_VALUE; Bit 20: (value 1048576) PGS_CSC_ECItoECR() gave PGS_E_TOOLKIT; Bit 21: (value 2097152) PGS_CSC_ECRtoGEO() gave PGSCSC_W_TOO_MANY_ITERS; Bit 22: (value 4194304) PGS_CSC_ECRtoGEO() gave PGSCSC_W_INVALID_ALTITUDE; Bit 23: (value 8388608) PGS_CSC_ECRtoGEO() gave PGSCSC_W_SPHERE_BODY;

			Bit 24: (value 16777216) PGS_CSC_ECRtoGEO() gave PGSCSC_W_LARGE_FLATTENING; Bit 25: (value 33554432) PGS_CSC_ECRtoGEO() gave PGSCSC_W_DEFAULT_EARTH_MODEL; Bit 26: (value 67108864) PGS_CSC_ECRtoGEO() gave PGSCSC_E_BAD_EARTH_MODEL; Bit 27: (value 134217728) PGS_CSC_ECRtoGEO() gave PGS_E_TOOLKIT; Bit 28-31: not used
glintgeoqa	16-bit unsigned integer	None	Glint Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) glint location in Earth's shadow (Normal for night FOVs); Bit 2: (value 4) glint calculation not converging; Bit 3: (value 8) glint location sun vs. satellite zenith mismatch; Bit 4: (value 16) glint location sun vs. satellite azimuth mismatch; Bit 5: (value 32) bad glint location; Bit 6: (value 64) PGS_CSC_ZenithAzimuth() gave any 'W' class return code; Bit 7: (value 128) PGS_CSC_ZenithAzimuth() gave any 'E' class return code; Bit 8: (value 256) PGS_CBP_Earth_CB_Vector() gave any 'W' class return code; Bit 9: (value 512) PGS_CBP_Earth_CB_Vector() gave any 'E' class return code; Bit 10: (value 1024) PGS_CSC_ECItoECR() gave any 'W' class return code except PGSCSC_W_PREDICTED_UT1 (for Glint); Bit 11: (value 2048) PGS_CSC_ECItoECR() gave any 'E' class return code (for Glint); Bit 12: (value 4096) PGS_CSC_ECRtoGEO() gave any 'W' class return code (for Glint); Bit 13: (value 8192) PGS_CSC_ECRtoGEO() gave any 'E' class return code (for Glint); Bit 14: (value 16384) PGS_CSC_ECItoECR() gave any 'W' class return code except PGSCSC_W_PREDICTED_UT1 ; Bit 15: (value 32768) PGS_CSC_ECItoECR() gave any 'E' class return code
moongeoqa	16-bit unsigned integer	None	Moon Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) PGS_TD_TAItoUTC() gave PGSTD_E_NO_LEAP_SECS; Bit 2: (value 4) PGS_TD_TAItoUTC() gave PGS_E_TOOLKIT; Bit 3: (value 8) PGS_CBP_Sat_CB_Vector() gave PGSCSC_W_BELOW_SURFACE; Bit 4: (value 16) PGS_CBP_Sat_CB_Vector() gave PGSCBP_W_BAD_CB_VECTOR; Bit 5: (value 32) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_BAD_ARRAY_SIZE; Bit 6: (value 64) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_INVALID_CB_ID; Bit 7: (value 128) PGS_CBP_Sat_CB_Vector() gave PGSMEM_E_NO_MEMORY; Bit 8: (value 256) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_UNABLE_TO_OPEN_FILE; Bit 9: (value 512) PGS_CBP_Sat_CB_Vector() gave PGSTD_E_BAD_INITIAL_TIME; Bit 10: (value 1024) PGS_CBP_Sat_CB_Vector() gave PGSCBP_E_TIME_OUT_OF_RANGE; Bit 11: (value 2048) PGS_CBP_Sat_CB_Vector() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 12: (value 4096) PGS_CBP_Sat_CB_Vector() gave PGSEPH_E_BAD_EPHEM_FILE_HDR; Bit 13: (value 8192) PGS_CBP_Sat_CB_Vector() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 14: (value 16384) PGS_CBP_Sat_CB_Vector() gave PGS_E_TOOLKIT; Bit 15: not used
nadirTAI	64-bit floating-point	None	TAI time at which instrument is nominally looking directly down. (between footprints 15 & 16 for AMSU or between footprints 45 & 46 for AIRS/Vis & HSB) (floating-point elapsed seconds since start of 1993)
sat_lat	64-bit floating-point	None	Satellite geodetic latitude in degrees North (-90.0 ... 90.0)
sat_lon	64-bit floating-point	None	Satellite geodetic longitude in degrees East (-180.0 ... 180.0)
scan_node_type	8-bit integer	None	'A' for ascending, 'D' for descending, 'E' when an error is encountered in trying to determine a value.
glintlat	32-bit floating-	None	Solar glint geodetic latitude in degrees North at nadirTAI (-90.0 ... 90.0)

	point		
glintlon	32-bit floating-point	None	Solar glint geodetic longitude in degrees East at nadirTAI (-180.0 ... 180.0)

3.6 Full Swath Data Fields

These fields appear for every footprint of every scanline in the granule (GeoTrack * GeoXTrack times).

Name	Type	Extra Dimensions	Explanation
ftptgeoqa	32-bit unsigned integer	None	Footprint Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) PGS_TD_TAItoUTC() gave PGSTD_E_NO_LEAP_SECS; Bit 2: (value 4) PGS_TD_TAItoUTC() gave PGS_E_TOOLKIT; Bit 3: (value 8) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_MISS_EARTH; Bit 4: (value 16) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_SC_TAG_UNKNOWN; Bit 5: (value 32) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_ZERO_PIXEL_VECTOR; Bit 6: (value 64) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_BAD_EPH_FOR_PIXEL; Bit 7: (value 128) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_INSTRUMENT_OFF_BOARD; Bit 8: (value 256) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_BAD_ACCURACY_FLAG; Bit 9: (value 512) PGS_CSC_GetFOV_Pixel() gave PGSCSC_E_BAD_ARRAY_SIZE; Bit 10: (value 1024) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_DEFAULT_EARTH_MODEL; Bit 11: (value 2048) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_DATA_FILE_MISSING; Bit 12: (value 4096) PGS_CSC_GetFOV_Pixel() gave PGSCSC_E_NEG_OR_ZERO_RAD; Bit 13: (value 8192) PGS_CSC_GetFOV_Pixel() gave PGSMEM_E_NO_MEMORY; Bit 14: (value 16384) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_NO_LEAP_SECS; Bit 15: (value 32768) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_TIME_FMT_ERROR; Bit 16: (value 65536) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_TIME_VALUE_ERROR; Bit 17: (value 131072) PGS_CSC_GetFOV_Pixel() gave PGSCSC_W_PREDICTED_UT1; Bit 18: (value 262144) PGS_CSC_GetFOV_Pixel() gave PGSTD_E_NO_UT1_VALUE; Bit 19: (value 524288) PGS_CSC_GetFOV_Pixel() gave PGS_E_TOOLKIT; Bit 20: (value 1048576) PGS_CSC_GetFOV_Pixel() gave PGSEPH_E_BAD_EPHEM_FILE_HDR; Bit 21: (value 2097152) PGS_CSC_GetFOV_Pixel() gave PGSEPH_E_NO_SC_EPHEM_FILE; Bit 22-31: not used
zengeoqa	16-bit unsigned integer	None	Satellite zenith Geolocation QA flags: Bit 0: (LSB, value 1) (Spacecraft) bad input value; Bit 1: (value 2) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_W_BELOW_HORIZON; Bit 2: (value 4) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_W_UNDEFINED_AZIMUTH; Bit 3: (value 8) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_W_NO_REFRACTION;

			Bit 4: (value 16) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_E_INVALID_VECTAG; Bit 5: (value 32) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_E_LOOK_PT_ALTIT_RANGE; Bit 6: (value 64) PGS_CSC_ZenithAzimuth(S/C) gave PGSCSC_E_ZERO_INPUT_VECTOR; Bit 7: (value 128) PGS_CSC_ZenithAzimuth(S/C) gave PGS_E_TOOLKIT; Bit 8: (value 256) (Sun) bad input value; Bit 9: (value 512) (suppressed) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_W_BELOW_HORIZON (This is not an error condition - the sun is below the horizon at night); Bit 10: (value 1024) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_W_UNDEFINED_AZIMUTH; Bit 11: (value 2048) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_W_NO_REFRACTION; Bit 12: (value 4096) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_E_INVALID_VECTAG; Bit 13: (value 8192) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_E_LOOK_PT_ALTIT_RANGE; Bit 14: (value 16384) PGS_CSC_ZenithAzimuth(Sun) gave PGSCSC_E_ZERO_INPUT_VECTOR; Bit 15: (value 32768) PGS_CSC_ZenithAzimuth(Sun) gave PGS_E_TOOLKIT
demgeoqa	16-bit unsigned integer	None	Digital Elevation Model (DEM) Geolocation QA flags: Bit 0: (LSB, value 1) bad input value; Bit 1: (value 2) Could not allocate memory; Bit 2: (value 4) Too close to North or South pole. Excluded. (This is not an error condition - a different model is used); Bit 3: (value 8) Layer resolution incompatibility. Excluded; Bit 4: (value 16) Any DEM Routine (elev) gave PGSDEM_E_IMPROPER_TAG; Bit 5: (value 32) Any DEM Routine (elev) gave PGSDEM_E_CANNOT_ACCESS_DATA; Bit 6: (value 64) Any DEM Routine (land/water) gave PGSDEM_E_IMPROPER_TAG; Bit 7: (value 128) Any DEM Routine (land/water) gave PGSDEM_E_CANNOT_ACCESS_DATA; Bit 8: (value 256) Reserved for future layers; Bit 9: (value 512) Reserved for future layers; Bit 10: (value 1024) PGS_DEM_GetRegion(elev) gave PGSDEM_M_FILLVALUE_INCLUDED; Bit 11: (value 2048) PGS_DEM_GetRegion(land/water) gave PGSDEM_M_FILLVALUE_INCLUDED; Bit 12: (value 4096) Reserved for future layers; Bit 13: (value 8192) PGS_DEM_GetRegion(all) gave PGSDEM_M_MULTIPLE_RESOLUTIONS; Bit 14: (value 16384) PGS_CSC_GetFOV_Pixel() gave any 'W' class return code except PGSCSC_W_PREDICTED_UT1; Bit 15: (value 32768) PGS_CSC_GetFOV_Pixel() gave any 'E' class return code
satzen	32-bit floating-point	None	Spacecraft zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
satazi	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO)
solzen	32-bit floating-point	None	Solar zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.)
solazi	32-bit floating-	None	Solar azimuth angle (-180.0 ... 180.0) degrees E of N GEO)

	point		
sun_glint_distance	16-bit integer	None	Distance (km) from footprint center to location of the sun glint (-9999 for unknown, 30000 for no glint visible because spacecraft is in Earth's shadow)
topog	32-bit floating-point	None	Mean topography in meters above reference ellipsoid
topog_err	32-bit floating-point	None	Error estimate for topog
landFrac	32-bit floating-point	None	Fraction of spot that is land (0.0 ... 1.0)
landFrac_err	32-bit floating-point	None	Error estimate for landFrac
satzen_amsu	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (AMSU-A FOV center)
satazi_amsu	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (AMSU-A FOV center)
satzen_hsb	32-bit floating-point	None	Satellite zenith angle (0.0 ... 180.0) degrees from zenith (measured relative to the geodetic vertical on the reference (WGS84) spheroid and including corrections outlined in EOS SDP toolkit for normal accuracy.) (HSB center FOV)
satazi_hsb	32-bit floating-point	None	Spacecraft azimuth angle (-180.0 ... 180.0) degrees E of N GEO (HSB center FOV)
MoonInViewIR	16-bit integer	None	Flag if moon was in the spaceview for IR calibration. IR calibration will handle this case, but there may be a small degradation in radiance quality. (1: moon in spaceview, 0: moon not in spaceview, -9999: unknown)
latAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center latitude of AIRS spots in degrees North (-90.0 ... 90.0)
lonAIRS	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Geodetic center longitude of AIRS spots in degrees East (-180.0 ... 180.0)
dust_flag	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Flag telling whether dust was detected in this scene; 1: Dust detected; 0: Dust not detected; -1: Dust test not valid because of land; -2: Dust test not valid because of high latitude; -3: Dust test not valid because of suspected cloud; -4: Dust test not valid because of bad input data
dust_score	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Dust score. Each bit results from a different test comparing radiances. Higher scores indicate more certainty of dust present. Dust probable when score is over 380. Not valid when dust_flag is negative.
BT_diff_SO2	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Brightness temperature difference Tb(1361.44 cm-1) - Tb(1433.06 cm-1) used as an indicator of SO2 release from volcanoes. Values under -6 K have likely volcanic SO2. (Kelvins)
spectral_clear_indicator	16-bit integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Flag telling whether scene was flagged as clear by a spectral filter. Only ocean filter is validated; 2: Ocean test applied and scene identified as clear; 1: Ocean test applied and scene not identified as clear;

			0: Calculation could not be completed. Possibly some inputs were missing or FOV is on coast or on the edge of a scan or granule; -1: Unvalidated land test applied and scene not identified as clear; -2: Unvalidated land test applied and scene identified as clear
num_clear_spectral_indicator	16-bit integer	None	Number of 9 IR FOVs which are clear according to spectral_clear_indicator. -1 when the spectral clear indicator could not be applied to any of the spots. Note that the spectral clear indicator is not validated for land scenes.
nchan_big_ang_adj	16-bit integer	None	The number of good chans with an angle adjustment over 20 * noise level in at least one of the 6 angle-adjusted IR FOVs.
PrecipAA4_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 4 (-1/255 for unknown)
PrecipAA5_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 5 (-1/255 for unknown)
PrecipAA6_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 6 (-1/255 for unknown)
PrecipAA7_50km	8-bit unsigned integer	None	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 (-1/255 for unknown)
PrecipAA8_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 8 (-1/255 for unknown)
PrecipAA9_50km	8-bit unsigned integer	None	Relative interference (0-2) of precipitation on AMSU-A channel 9 (-1/255 for unknown)
PrecipAA4_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 4 for HSB 15-km spots (-1/255 for unknown)
PrecipAA5_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 5 for HSB 15-km spots (-1/255 for unknown)
PrecipAA6_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 6 for HSB 15-km spots (-1/255 for unknown)
PrecipAA7_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2, 3=indeterminate) of precipitation on AMSU-A channel 7 for HSB 15-km spots (-1/255 for unknown)
PrecipAA8_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 8 for HSB 15-km spots (-1/255 for unknown)
PrecipAA9_15km	8-bit unsigned integer	AIRSTrack (= 3) * AIRSXTrack (= 3)	Relative interference (0-2) of precipitation on AMSU-A channel 9 for HSB 15-km spots (-1/255 for unknown)
AMSU_A_4_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 4 for precipitation effects (Kelvins)
AMSU_A_5_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 5 for precipitation effects (Kelvins)
AMSU_A_6_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 6 for precipitation effects (Kelvins)

AMSU_A_7_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 7 for precipitation effects (Kelvins)
AMSU_A_8_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 8 for precipitation effects (Kelvins)
AMSU_A_9_Precip_Corr_50km	32-bit floating-point	None	Correction to AMSU-A channel 9 for precipitation effects (Kelvins)
AMSU_A_4_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 4 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_5_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 5 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_6_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 6 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_7_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 7 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_8_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 8 for precipitation effects for HSB 15-km spots (Kelvins)
AMSU_A_9_Precip_Corr_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Correction to AMSU-A channel 9 for precipitation effects for HSB 15-km spots (Kelvins)
rain_rate_50km	32-bit floating-point	None	Rain rate (mm/hr)
rain_rate_15km	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Rain rate for HSB 15-km spots (mm/hr)
Qual_Precip_Est	16-bit unsigned integer	None	Quality flag for IR_Precip_Est. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
IR_Precip_Est	32-bit floating-point	None	Regression-based estimate of daily precipitation based on clouds and relative humidity from Level 2 IR/MW retrieval. Analogous to and forms a continuous record when used with TOVS precipitation index. (mm/day)
IR_Precip_Est_Err	32-bit floating-point	None	Error estimate for IR_Precip_Est
Qual_Clim_Ind	16-bit unsigned integer	None	Quality flag for Coarse climate indicators Tropo_CCI and Strato_CCI. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Tropo_CCI	32-bit floating-point	None	A Tropospheric Coarse Climate Indicator representing the weighted average of retrieved temperatures over the lower troposphere (maximum weight near 700 mb). The weighting is done in such a manner as to make the weighted temperatures roughly correspond to those given by the MSU2R products in the Spencer and Christy temperature data set, as well as in the TOVS Pathfinder Path A data set (K)
Tropo_CCI_Est_Err	32-bit floating-point	None	Error estimate for Tropo_CCI
Strato_CCI	32-bit floating-point	None	A Stratospheric Coarse Climate Indicator representing the weighted average of retrieved temperatures over the lower stratosphere (maximum weight near 70 mb). The

			weighting is done in such a manner as to make the weighted temperatures roughly correspond to those given by the MSU4 products in the Spencer and Christy temperature data set, as well as in the TOVS Pathfinder Path A data set (K)
Strato_CCI_Est_Err	32-bit floating-point	None	Error estimate for Strato_CCI
MWSurfClass	8-bit integer	None	Surface class from microwave (MW) information: 0 for coastline (Liquid water covers 50-99% of area); 1 for land (Liquid water covers < 50% of area); 2 for ocean (Liquid water covers > 99% of area); 3 for sea ice (High MW emissivity); 4 for sea ice (Low MW emissivity); 5 for snow (Higher-frequency MW scattering); 6 for glacier/snow (Very low-frequency MW scattering); 7 for snow (Lower-frequency MW scattering); -1 for unknown (not attempted)
SurfClass	8-bit integer	None	Surface class used in physical retrieval, from microwave (MW) and/or infrared (IR). Identical to MWSurfClass when MW is used: 0 for coastline (Liquid water covers 50-99% of area); 1 for land (Liquid water covers < 50% of area); 2 for ocean (Liquid water covers > 99% of area); 3 for sea ice (Indicates high MW emissivity when MW information is used); 4 for sea ice (Indicates low MW emissivity. This value is only produced when MW information is used.); 5 for snow (Indicates higher-frequency MW scattering when MW information is used); 6 for glacier/snow (Indicates very low-frequency MW scattering. This value is only produced when MW information is used.); 7 for snow (Indicates lower-frequency MW scattering. This value is only produced when MW information is used.); -1 for unknown
FracLandPlusIce	32-bit floating-point	None	Fraction of scene assumed by physical retrieval to be covered by land or ice
sfcTbMWStd	32-bit floating-point	MWHingeSurf (= 7)	Microwave surface brightness (Kelvins) (Emitted radiance only, reflected radiance not included. Product of MW only algorithm)
EmisMWStd	32-bit floating-point	MWHingeSurf (= 7)	Spectral MW emissivity at the 7 MW frequencies listed for dimension MWHingeSurf (Product of MW only algorithm)
EmisMWStdErr	32-bit floating-point	MWHingeSurf (= 7)	Error estimate for EmisMWStd
Emis50GHz	32-bit floating-point	None	Microwave emissivity at 50.3 GHz (This is from combined IR/MW retrieval. The shape of MW spectral emissivity stays the same as MW only algorithm.)
Qual_Guess_PSurf	16-bit unsigned integer	None	Quality flag for surface pressure guess input.0: Highest Quality -- from timely forecast; 1: Good Quality -- from climatology; 2: Do Not Use
PSurfStd	32-bit floating-point	None	Surface pressure first guess in mbar, interpolated from forecast
nSurfSup	32-bit integer	None	Index of first pressure level above mean surface (90 ... 100)
nBestSup	16-bit integer	None	Support level index of highest pressure (i.e. lowest altitude)for which Quality = 0. A value of 0 indicates that no part of the profile passes the test. (0 ... 100)

nGoodSup	16-bit integer	None	Support level index of highest pressure (i.e. lowest altitude)for which Quality = 0 or 1. A value of 0 indicates that no part of the profile passes the test. (0 ... 100)
PBest	32-bit floating-point	None	Maximum value of pressure for which temperature is Quality = 0 (mbar)
PGood	32-bit floating-point	None	Maximum value of pressure for which temperature is Quality = 0 or 1 (mbar)
nSurfStd	32-bit integer	None	Index in pressStd array of first pressure level above mean surface (1 ... 15)
nBestStd	16-bit integer	None	Standard level index of highest pressure (i.e. lowest altitude)for which Quality = 0. A value of 29 indicates that no part of the profile passes the test. (1 ... 29)
nGoodStd	16-bit integer	None	Standard level index of highest pressure (i.e. lowest altitude)for which Quality = 0 or 1. A value of 29 indicates that no part of the profile passes the test. (1 ... 29)
Press_mid_top_bndry	32-bit floating-point	None	Pressure level in mbar, at and above which the quality of the temperature profile is given by Qual_Temp_Profile_top. Below this level use Qual_Temp_Profile_mid.
Press_bot_mid_bndry	32-bit floating-point	None	Pressure level in mbar, at and below which the quality of the temperature profile is given by Qual_Temp_Profile_bot. Above this level use Qual_Temp_Profile_mid.
nSup_mid_top_bndry	16-bit integer	None	Index of nearest support pressure level nearest Press_mid_top_bndry (1 ... 100)
nSup_bot_mid_bndry	16-bit integer	None	Index of nearest support pressure level nearest Press_bot_mid_bndry (1 ... 100)
nStd_mid_top_bndry	16-bit integer	None	Index of nearest standard pressure level nearest Press_mid_top_bndry (1 ... 28)
nStd_bot_mid_bndry	16-bit integer	None	Index of nearest standard pressure level nearest Press_bot_mid_bndry (1 ... 28)
Qual_Temp_Profile_Top	16-bit unsigned integer	None	Quality flag for temperature profile at and above Press_mid_top_bndry mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Mid	16-bit unsigned integer	None	Quality flag for temperature profile below Press_mid_top_bndry mbar and above Press_bot_mid_bndry mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_Temp_Profile_Bot	16-bit unsigned integer	None	Quality flag for temperature profile at and below Press_bot_mid_bndry mbar, including surface air temperature. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TAirSup	32-bit floating-point	XtraPressureLev (= 100)	Atmospheric Temperature at XtraPressLev in Kelvins. Value at 1-based index of nSurfSup may be an unphysical extrapolated value for a pressure level below the surface. Use TSurfAir for the surface air temperature.
TAirSupErr	32-bit floating-point	XtraPressureLev (= 100)	Error estimate for TAirSup (K)
num_Temp_Func	16-bit integer	None	Number of valid entries in each dimension of Temp_ave_kern.
Temp_ave_kern	32-bit floating-point	TempFunc (= 23) * TempFunc (= 23)	Averaging kernel for temperature retrieval.
TSurfAir	32-bit	None	Surface air temperature in Kelvins

	floating-point		
TSurfAirErr	32-bit floating-point	None	Error estimate for TSurfAir
Qual_Surf	16-bit unsigned integer	None	Overall quality flag for surface fields including surface temperature, emissivity, and reflectivity. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TSurfStd	32-bit floating-point	None	Surface skin temperature in Kelvins
TSurfStdErr	32-bit floating-point	None	Error estimate for TSurfStd
numHingeSurf	16-bit integer	None	Number of IR hinge points for surface emissivity and reflectivity
freqEmis	32-bit floating-point	HingeSurf (= 100)	Frequencies for surface emissivity and reflectivity in cm-1 (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStd	32-bit floating-point	HingeSurf (= 100)	Spectral IR Surface Emissivities (in order of increasing frequency. Only first numHingeSurf elements are valid)
emisIRStdErr	32-bit floating-point	HingeSurf (= 100)	Error estimate for emisIRStd
Effective_Solar_Reflectance	32-bit floating-point	HingeSurf (= 100)	Effective spectral IR bidirectional surface solar reflectance, including cloud shadow effects (in order of increasing frequency. Only first numHingeSurf elements are valid)
Qual_H2O	16-bit unsigned integer	None	Overall quality flag for water vapor fields. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
H2OCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor (molecules / cm**2)
H2OCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for H2OCDSup (unitless fraction of H2OCDSup)
totH2OStd	32-bit floating-point	None	Total precipitable water vapor (kg / m**2)
totH2OStdErr	32-bit floating-point	None	Error estimate for totH2OStd
num_H2O_Func	16-bit integer	None	Number of valid entries in each dimension of H2O_ave_kern.
H2O_verticality	32-bit floating-point	H2OFunc (= 11)	Sum of the rows of H2O_ave_kern.
H2O_ave_kern	32-bit floating-point	H2OFunc (= 11) * H2OFunc (= 11)	Averaging kernel for water vapor retrieval.
H2O_VMR_eff	32-bit floating-point	H2OFunc (= 11)	Effective H2O volume mixing ratio for each trapezoid.
H2O_eff_press	32-bit floating-point	H2OFunc (= 11)	H20 effective pressure for the center of each trapezoid
H2O_dof	32-bit	None	Measure of the amount of information in H2O retrieval

	floating-point		(deg of freedom).
lwCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer molecular column density (molecules / cm**2) of cloud liquid water
lwCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for lwCDSup (unitless fraction of LwCDSup)
cIWSup	32-bit integer	XtraPressureLay (= 100)	Cloud Ice/Water flag (liquid = 0 / Ice = 1)
Qual_O3	16-bit unsigned integer	None	Quality flag for ozone. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
totO3Std	32-bit floating-point	None	Total ozone burden (Dobson units)
totO3StdErr	32-bit floating-point	None	Error estimate for totO3Std
O3CDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column ozone in molecules per cm**2
num_O3_Func	16-bit integer	None	Number of valid entries in each dimension of O3_ave_kern.
O3_eff_press	32-bit floating-point	O3Func (= 9)	O3 effective pressure for the center of each trapezoid
O3_VMR_eff	32-bit floating-point	O3Func (= 9)	Effective O3 volume mixing ratio for each trapezoid.
O3_verticality	32-bit floating-point	O3Func (= 9)	Sum of the rows of O3_ave_kern.
O3_ave_kern	32-bit floating-point	O3Func (= 9) * O3Func (= 9)	Averaging kernel for ozone retrieval.
O3CDInit	32-bit floating-point	XtraPressureLay (= 100)	preliminary Layer column ozone in molecules per cm**2 from initial regression step
Qual_CO	16-bit unsigned integer	None	Quality flag for carbon monoxide. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CO_total_column	32-bit floating-point	None	Retrieved total column CO (molecules/cm2).
COCDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column carbon monoxide in molecules per cm**2 (climatology when bad_co is not 0)
COCDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for COCDSup
num_CO_Func	16-bit integer	None	Number of valid entries in each dimension of CO_ave_kern.
CO_eff_press	32-bit floating-point	COFunc (= 9)	CO effective pressure for the center of each trapezoid
CO_VMR_eff	32-bit floating-point	COFunc (= 9)	Effective CO volume mixing ratio for each trapezoid.

CO_VMR_eff_err	32-bit floating-point	COFunc (= 9)	Error estimate for CO_VMR_eff
CO_verticality	32-bit floating-point	COFunc (= 9)	Sum of the rows of CO_ave_kern.
CO_dof	32-bit floating-point	None	Measure of the amount of information in CO retrieval (deg of freedom).
CO_ave_kern	32-bit floating-point	COFunc (= 9) * COFunc (= 9)	Averaging kernel for carbon monoxide retrieval.
Qual_CO2	16-bit unsigned integer	None	Quality flag for carbon dioxide. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_CH4	16-bit unsigned integer	None	Quality flag for methane. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
CH4_total_column	32-bit floating-point	None	Retrieved total column CH4 (molecules/cm2).
CH4CDSup	32-bit floating-point	XtraPressureLay (= 100)	Layer column methane (in molecules per cm**2)
CH4CDSupErr	32-bit floating-point	XtraPressureLay (= 100)	Error estimate for CH4CDSup
num_CH4_Func	16-bit integer	None	Number of valid entries in each dimension of CH4_ave_kern.
CH4_eff_press	32-bit floating-point	CH4Func (= 7)	CH4 effective pressure for the center of each trapezoid
CH4_VMR_eff	32-bit floating-point	CH4Func (= 7)	Effective CH4 volume mixing ratio for each trapezoid.
CH4_VMR_eff_err	32-bit floating-point	CH4Func (= 7)	Error estimate for CH4_VMR_eff
CH4_verticality	32-bit floating-point	CH4Func (= 7)	Sum of the rows of CH4_ave_kern.
CH4_dof	32-bit floating-point	None	Measure of the amount of information in CH4 retrieval (deg of freedom).
CH4_ave_kern	32-bit floating-point	CH4Func (= 7) * CH4Func (= 7)	Averaging kernel for methane retrieval.
CO2ppmv	32-bit floating-point	None	Column averaged dry carbon dioxide volumetric mixing ratio (ppmv)
CO2ppmvErr	32-bit floating-point	None	Error estimate for CO2ppmv (unitless fraction of CO2ppmv)
PTropopause	32-bit floating-point	None	Tropopause height (mbar)
T_Tropopause	32-bit floating-point	None	Tropopause temperature (K)
GP_Tropopause	32-bit	None	Geopotential height at tropopause (m above mean sea

	floating-point		level)
GP_Surface	32-bit floating-point	None	Geopotential Height of surface (m above mean sea level)
emisIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Emissivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
rhoIRInit	32-bit floating-point	HingeSurfInit (= 50)	IR Surface Reflectivities from initial regression (in order of increasing frequency. Only first numHingeSurfInit elements are valid)
Qual_Cloud_OLR	16-bit unsigned integer	None	Overall quality flag for cloud parameters and cloudy OLR. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
olr	32-bit floating-point	None	Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
olr_err	32-bit floating-point	None	Error estimate for olr (Watts/m**2)
Qual_clrolr	16-bit unsigned integer	None	Quality flag for clrolr. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
clrolr	32-bit floating-point	None	Clear-sky Outgoing Longwave Radiation Flux integrated over 2 to 2800 cm**-1 (Watts/m**2)
clrolr_err	32-bit floating-point	None	Error estimate for clrolr (Watts/m**2)
numCloud	32-bit integer	None	Number of cloud layers
TCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top temperature in Kelvins (in order of increasing pressure. Only first numCloud elements are valid)
TCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for TCldTopStd
PCldTopStd	32-bit floating-point	Cloud (= 2)	Cloud top pressure in mbar
PCldTopStdErr	32-bit floating-point	Cloud (= 2)	Error estimate for PCldTopStd
CldFrcStd	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Cloud fraction (0.0 ... 1.0) assuming unit cloud top emissivity (in order of increasing pressure. Only first numCloud elements are valid) Caution: For Qual_Cloud_OLR = 1, only the average cloud fraction over the nine spots is reported (duplicated nine times) for each level.
CldFrcStdErr	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * Cloud (= 2)	Error estimate for CldFrcStd
numHingeCloud	16-bit integer	None	Number of hinge points for cloud emissivity and reflectivity
cldFreq	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Frequencies for cloud emissivity and reflectivity (in order of increasing pressure. Only first numCloud elements are valid) (in order of increasing frequency. Only first numHingeCloud elements are valid)
CldEmis	32-bit	Cloud (= 2) *	Ratio of cloud IR emissivity to that at 930 cm-1 (in order of

	floating-point	HingeCloud (= 7)	increasing frequency. Only first numHingeCloud elements are valid)
CldEmisErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldEmis
CldRho	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Future Cloud IR reflectivity -- DO NOT USE
CldRhoErr	32-bit floating-point	Cloud (= 2) * HingeCloud (= 7)	Error estimate for CldRho
cornerlats	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * VisGeoSpots (= 4) * VChn (= 4)	Geodetic Latitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees North (-90.0 ... 90.0)
cornerlons	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3) * VisGeoSpots (= 4) * VChn (= 4)	Geodetic Longitudes at the centers of the pixels at the corners of the IR footprint by channel in degrees East (-180.0 ... 180.0)
tsurf_forecast	32-bit floating-point	None	Predicted surface temperature from forecast (K)
pseudo_lapse_rate	32-bit floating-point	AIRSTrack (= 3) * AIRSXTrack (= 3)	Pseudo lapse rate is BT diff of channels 2109 and 2108 (K). Their frequencies are 2388 and 2387 cm-1, respectively. Low values within +/-45 degrees of equator usually indicate existence of cloud. Use with caution at higher latitudes.
Qual_MW_Only_Temp_Strat	16-bit unsigned integer	None	Overall quality flag for MW-Only temperature fields for altitudes above 201 mbar. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
Qual_MW_Only_Temp_Tropo	16-bit unsigned integer	None	Overall quality flag for MW-Only temperature fields for altitudes at and below 201 mbar, including surface temperature. 0: Highest Quality; 1: Good Quality; 2: Do Not Use
TAirMWOnly	32-bit floating-point	XtraPressureLev (= 100)	Air temperature in Kelvins from startup microwave-only retrieval.
TAirMWOnlyErr	32-bit floating-point	StdPressureLev (= 28)	Error estimate for TAirMWOnly (Note that error estimate only made at StdPressureLev points even though TAirMWOnly is estimated at XtraPressureLev points)
TAirCldyReg	32-bit floating-point	XtraPressureLev (= 100)	Air temperature in Kelvins from startup cloudy regression retrieval.
Qual_MW_Only_H2O	16-bit unsigned integer	None	Quality flag for MW-Only water fields; 0: Highest Quality -- Use both column totals (totH2OMWOnlyStd and totCldH2OStd) and profiles in support product (H2OCDMWOnly and lwCDSup); 1: Good Quality -- Use column totals but not profiles; 2: Do Not Use
totH2OMWOnlyStd	32-bit floating-point	None	Total precipitable water vapor from MW-only retrieval (no IR information used) (kg / m**2)
H2OCDMWOnly	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor from microwave-only retrieval. (molecules / cm**2)
H2OCDCldyReg	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor from cloudy regression retrieval. (molecules / cm**2)
TSurf1Ret	32-bit	None	Surface temperature after first retrieval in Kelvins

	floating-point		
TSurfAir1Ret	32-bit floating-point	None	Surface air temperature after first retrieval in Kelvins
TAir1Ret	32-bit floating-point	XtraPressureLev (= 100)	Air temperature after first retrieval in Kelvins
H2OCD1Ret	32-bit floating-point	XtraPressureLay (= 100)	Layer column water vapor after first retrieval (molecules / cm**2)
startup_psurf_range	8-bit integer	None	Surface pressure check for startup microwave-only or cloudy regression retrieval. See Startup to determine source. Bit 7: unused, set to zero; Bit 6 (value 64): Invalid input; Bit 5 (value 32): high input value error; Bit 4 (value 16): low input value error; Bit 3 (value 8): high input value warning; Bit 2 (value 4): low input value warning; Bit 1 (value 2): input value high, but not enough for warning; Bit 0 (LSB, value 1): input value low, but not enough for warning
startup_tsurf_range	8-bit integer	None	Retrieved surface temperature check for startup microwave-only or cloudy regression retrieval. See Startup to determine source. Bit 7: unused, set to zero; Bit 6 (value 64): Invalid input; Bit 5 (value 32): high input value error; Bit 4 (value 16): low input value error; Bit 3 (value 8): high input value warning; Bit 2 (value 4): low input value warning; Bit 1 (value 2): input value high, but not enough for warning; Bit 0 (LSB, value 1): input value low, but not enough for warning
startup_tair_range	Profile range check (see below)	None	Retrieved air temperature profile check for startup microwave-only or cloudy regression retrieval. See Startup to determine source.
reg_psurf_range	8-bit integer	None	Surface pressure check for regression retrieval product: Bit 7: unused, set to zero; Bit 6 (value 64): Invalid input; Bit 5 (value 32): high input value error; Bit 4 (value 16): low input value error; Bit 3 (value 8): high input value warning; Bit 2 (value 4): low input value warning; Bit 1 (value 2): input value high, but not enough for warning; Bit 0 (LSB, value 1): input value low, but not enough for warning
reg_tsurf_range	8-bit integer	None	Retrieved surface temperature check for regression retrieval product: Bit 7: unused, set to zero; Bit 6 (value 64): Invalid input; Bit 5 (value 32): high input value error; Bit 4 (value 16): low input value error; Bit 3 (value 8): high input value warning; Bit 2 (value 4): low input value warning; Bit 1 (value 2): input value high, but not enough for warning; Bit 0 (LSB, value 1): input value low, but not enough for warning
reg_tair_range	Profile range check (see below)	None	retrieved air temperature profile check for regression retrieval product

reg_h2ocd_range	Profile range check (see below)	None	retrieved water vapor temperature profile check for regression retrieval product
reg_ozocd_range	Profile range check (see below)	None	retrieved ozone temperature profile check for regression retrieval product
reg_cocd_range	Profile range check (see below)	None	retrieved CO temperature profile check for regression retrieval product
reg_ch4cd_range	Profile range check (see below)	None	retrieved methane temperature profile check for regression retrieval product
fin_psurf_range	8-bit integer	None	Surface pressure check for final retrieval product: Bit 7: unused, set to zero; Bit 6 (value 64): Invalid input; Bit 5 (value 32): high input value error; Bit 4 (value 16): low input value error; Bit 3 (value 8): high input value warning; Bit 2 (value 4): low input value warning; Bit 1 (value 2): input value high, but not enough for warning; Bit 0 (LSB, value 1): input value low, but not enough for warning
fin_tsurf_range	8-bit integer	None	Retrieved surface temperature check for final retrieval product: Bit 7: unused, set to zero; Bit 6 (value 64): Invalid input; Bit 5 (value 32): high input value error; Bit 4 (value 16): low input value error; Bit 3 (value 8): high input value warning; Bit 2 (value 4): low input value warning; Bit 1 (value 2): input value high, but not enough for warning; Bit 0 (LSB, value 1): input value low, but not enough for warning
fin_tair_range	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product
fin_tair_range_hi	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product above Press_mid_top_bndry
fin_tair_range_mid	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product between Press_mid_top_bndry and Press_bot_mid_bndry
fin_tair_range_lo	Profile range check (see below)	None	retrieved air temperature profile check for final retrieval product below Press_bot_mid_bndry
fin_h2ocd_range	Profile range check (see below)	None	retrieved water vapor temperature profile check for final retrieval product
fin_ozocd_range	Profile range check (see below)	None	retrieved ozone temperature profile check for final retrieval product
fin_cocd_range	Profile	None	retrieved CO temperature profile check for final retrieval

	range check (see below)		product
fin_ch4cd_range	Profile range check (see below)	None	retrieved methane temperature profile check for final retrieval product
CC1_Noise_Amp	32-bit floating-point	None	Internal retrieval quality indicator -- noise amplification factor from first cloud clearing because of extrapolation, dimensionless
Tsurf_4_CC1	32-bit floating-point	None	Internal retrieval quality indicator -- surface temperature used in first cloud clearing
TotCld_4_CC1	32-bit floating-point	None	Internal retrieval quality indicator -- total cloud fraction estimate before the first cloud clearing
CC1_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from first cloud clearing. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations
CC2_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from second cloud clearing. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations
Phys_RCode	32-bit integer	None	Internal retrieval quality indicator -- return code from physical retrieval. Nonzero when code did not execute to completion due to internal computational checks. Most commonly due to ill-conditioned matrices resulting from inadequate information content in observations
TotCld_below_500mb	32-bit floating-point	None	Internal retrieval quality indicator -- estimated final cloud fraction due only to clouds below 500 mbar (as seen from above), dimensionless between zero and one
Phys_resid_AMSUA	32-bit floating-point	ChanAMSUA (= 15)	Residual for AMSU-A channels after final retrieval (K)
Phys_resid_IR_window_790	32-bit floating-point	None	Residual for IR window channel near 790 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_844	32-bit floating-point	None	Residual for IR window channel near 844 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_917	32-bit floating-point	None	Residual for IR window channel near 917 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_1231	32-bit floating-point	None	Residual for IR window channel near 1231 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_2513	32-bit floating-point	None	Residual for IR window channel near 2513 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
Phys_resid_IR_window_2616	32-bit floating-point	None	Residual for IR window channel near 2616 cm**-1 after final retrieval (K) (No tuning applied because it is a surface channel)
CC_noise_eff_amp_factor	32-bit floating-point	None	Effective amplification of noise in IR window channels due to extrapolation in cloud clearing and uncertainty of clear state. (< 1.0 for noise reduction, >1.0 for noise amplification, -9999.0 for unknown)
CC1_noise_eff_amp_factor	32-bit	None	Equivalent of CC_noise_eff_amp_factor but from the first

	floating-point		attempt at cloud clearing
totCldH2OStd	32-bit floating-point	None	Total cloud liquid water in kg/m**2
totCldH2OStdErr	32-bit floating-point	None	Error estimate for totCldH2OStd (unitless fraction of totCldH2OStd)
CC1_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the first cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
CCfinal_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual between the final cloud cleared radiances for channels used in the determination and the radiances calculated from the best estimate of clear, in K
CCfinal_Noise_Amp	32-bit floating-point	None	Internal retrieval quality indicator -- noise amplification factor from cloud clearing because of extrapolation, dimensionless. Note: the name is misleading: this is the value afterthe second cloud clearing iteration, not the last.
Tdiff_IR_MW_ret	32-bit floating-point	None	Internal retrieval quality indicator -- layer mean difference in lower atmosphere between final IR temperature retrieval and the last internal MW-only temperature determination. High values suggest problems with MW or problems with cloud clearing.
Tdiff_IR_4CC1	32-bit floating-point	None	Internal retrieval quality indicator -- layer mean difference in lower atmosphere between final IR temperature retrieval and the temperature used in the first cloud clearing.
TSurfdiff_IR_4CC1	32-bit floating-point	None	Internal retrieval quality indicator -- absolute value of surface temperature difference between final IR retrieval and the surface temperature used as input in the first cloud clearing.
TSurfdiff_IR_4CC2	32-bit floating-point	None	Internal retrieval quality indicator -- absolute value of surface temperature difference between final IR retrieval and the surface temperature used as input in the second cloud clearing.
AMSU_Chans_Resid	32-bit floating-point	None	Internal retrieval quality indicator -- residual of selected AMSU channels (currently channel 5 only) against that calculated from the final IR retrieval state, K. High values suggest lower atmosphere retrieval disagrees with MW due to problems with MW or cloud clearing.
TotCld_4_CCfinal	32-bit floating-point	None	Internal retrieval quality indicator -- total cloud fraction estimated before final cloud clearing (as seen from above), dimensionless between zero and one
Surf_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of surface channels as compared to predicted uncertainty (dimensionless factor)
Temp_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of temperature channels as compared to predicted uncertainty (dimensionless factor)
Water_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of water channels as compared to predicted uncertainty (dimensionless factor)
Cloud_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of cloud channels as compared to predicted uncertainty (dimensionless factor)
O3_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of ozone channels as compared to predicted uncertainty (dimensionless factor)
CO_Resid_Ratio	32-bit floating-	None	Internal retrieval quality indicator -- residuals of carbon monoxide channels as compared to predicted uncertainty

	point		(dimensionless factor)
CH4_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of methane channels as compared to predicted uncertainty (dimensionless factor)
MWCheck_Resid_Ratio	32-bit floating-point	None	Internal retrieval quality indicator -- residuals of channels used in MW check as compared to predicted uncertainty (dimensionless factor)
O3_dof	32-bit floating-point	None	Measure of the amount of information in O3 retrieval (deg of freedom).
invalid	8-bit integer	None	No valid output (1: True, 0: False, 255/-1: Unknown)
all_spots_avg	8-bit integer	None	1: the cloud clearing step judged the scene to be clear enough that it averaged all spots' radiances; 0: cloud clearing was applied to the radiances; -1/255: cloud clearing not attempted
MW_ret_used	8-bit integer	None	MW-only final retrieval used
bad_clouds	8-bit integer	None	invalid cloud parameters
retrieval_type	8-bit integer	None	Deprecated -- use species-specific Qual_Xxx instead. Retrieval type: 0 for full retrieval; 10 for MW + final succeeded, initial retrieval failed; 20 for MW + initial succeeded, final failed; 30 for only MW stage succeeded, initial + final retrieval failed; 40 for MW + initial succeeded, final cloud-clearing failed; 50 for only MW stage succeeded, initial + final cloud-clearing failed; 100 for no retrieval;
Startup	8-bit integer	None	Source of startup input atmospheric state used in first cloud clearing step.; 0: MW-only retrieval; 1: IR-Only cloudy regression; 2: IR+MW cloudy regression, with some info from MW-only physical retrieval
bad_l1b	8-bit integer	None	Level 2 process not allowed due to bad level 1b data
bad_l1b_amsu	8-bit integer	None	Bad AMSU-A level 1b data
bad_l1b_hsb	8-bit integer	None	Bad HSB level 1b data
bad_l1b_airs	8-bit integer	None	Bad AIRS level 1b data
bad_l1b_vis	8-bit integer	None	Bad VIS level 1b data
forecast	8-bit integer	None	Complete forecast guess was used
no_psurf_guess	8-bit integer	None	No surface pressure was available. Topography was used for surf press
bad_temps	8-bit integer	None	invalid temp and surface skin temp
bad_h2o	8-bit integer	None	invalid water vapor profile
bad_o3	8-bit integer	None	invalid ozone profile
bad_co	8-bit integer	None	Invalid CO profile (profiles with bad_co = 1 had successful physical retrieval of CO but unsuccessful physical retrieval overall. These had climatology COCDSup. This value is no longer used; Profiles with bad_co = 2 have failed or not attempted physical CO retrieval and also have climatology in COCDSup)
no_tuning	8-bit integer	None	Standard br temp tuning NOT applied
no_ang_corr	8-bit integer	None	Standard angle correction NOT applied
no_mw	8-bit integer	None	MW only retrieval not attempted
no_initial	8-bit integer	None	First retrieval not attempted

no_final	8-bit integer	None	Final retrieval not attempted
mw_fpe	8-bit integer	None	floating-point exception in MW-Only retrieval step
cloudy_reg_fpe	8-bit integer	None	floating-point exception in cloudy regression retrieval step
initial_fpe	8-bit integer	None	floating-point exception in Initial retrieval step
final_fpe	8-bit integer	None	floating-point exception in Final retrieval step
MWPrecip	8-bit integer	None	Precipitation was detected over 0.5 mm/hr
MWsurf_T0	32-bit floating-point	None	low-frequency surface adjustment parameter -- T0
MWsurf_Tinf	32-bit floating-point	None	high-frequency surface adjustment parameter -- Tinfinity
MWsecant_ratio	32-bit floating-point	None	ratio of reflected to direct path length (only valid for mostly-water scenes)
MWseaice_conc	32-bit floating-point	None	Fraction of field-of-view with frozen covering. For predominately water areas (landFrac < 0.5, MWSurfClass = 3,4) MWseaice_conc refers to sea ice and MWseaice_conc range is [0.05 ... (1.0 - landFrac)]. For predominately land areas (landFrac >= 0.5, MWSurfClass = 5,6,7) MWseaice_conc refers to snow/glacier and MWseaice_conc range is [0.0 ... 1.0]. Frozen surface of the minority element of a coastal field-of-view is not accounted for. Other surface classes have MWseaice_conc=0.0
MWresidual_temp	32-bit floating-point	None	sum of squares of temperature residuals normalized by channel sensitivities
MWresidual_mois	32-bit floating-point	None	sum of squares of moisture residuals normalized by channel sensitivities
MWresidual_AMSUA	32-bit floating-point	ChanAMSUA (= 15)	Brightness temperature residual for each AMSU-A channel (Kelvin)
MWresidual_HSB	32-bit floating-point	ChanHSB (= 5)	brightness temperature residual for each HSB channel (Kelvin)
MWiter_temp	8-bit integer	None	# of iterations of the temperature profile
MWiter_mois	8-bit integer	None	# of iterations of the moisture profile
mw_ret_code	8-bit integer	None	Return code status of MW retrieval: values can be summed if more than one applies: 0 All OK; 1 Moisture variables rejected by residual test; 2 Troposphere temperature profile rejected by residual test; 4 Excessive liquid water; 8 Insufficient valid channels; 16 Numerical error; 32 Emissivity > 1 for any AMSU-A channel; 64 Stratosphere temperature profile rejected by residual test; 128/-128 MW retrieval not attempted
cloudy_reg_ret_code	8-bit integer	None	Return code status of startup cloudy regression retrieval: values can be summed if more than one applies: 0 All OK; 1 Problem encountered; 16 Numerical error; 128/-128 Cloudy regression not attempted
Cloudy_Reg_FOV_chan	16-bit integer	None	Channel number (1-2378) of channel used to select from among the 9 IR FOVs the one to be used in cloudy regression (-9999 for N/A)
Cloudy_Reg_FOV	16-bit	None	FOV number of IR FOV used in cloudy regression (1-9, -

	integer		9999 for N/A)
Cloudy_Reg_FOV_BT	32-bit floating-point	None	Brightness temperature for channel Cloudy_Reg_FOV_chan at FOV Cloudy_Reg_FOV (K, -9999 for N/A)
Cloudy_Reg_Score	32-bit floating-point	None	Indicator of how well the initial cloudy radiances match radiances reconstructed from cloudy eigenvectors. (Unitless ratio; should be ~1.0; >10.0 indicates a major problem)
cloud_ice	8-bit integer	None	Scattering by cloud ice present in FOV
icc_too_cloudy	8-bit integer	None	Initial cloud clearing pass too cloudy
icc_low_contrast	8-bit integer	None	Initial cloud clearing pass contrast too low
icc_bad_rad	8-bit integer	None	Initial cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval
icc_contrast	32-bit floating-point	None	Initial cloud clearing contrast (units?)
bad_1st	8-bit integer	None	The initial retrieval failed
bad_1st_surf	8-bit integer	None	The initial surface retrieval failed
bad_1st_cc	8-bit integer	None	The first cloud clearing failed
bad_1st_regres	8-bit integer	None	The regression guess failed
bad_1st_phys	8-bit integer	None	The first physical retrieval failed
fcc_too_cloudy	8-bit integer	None	Final cloud clearing pass too cloudy
fcc_low_contrast	8-bit integer	None	Final cloud clearing pass contrast too low
fcc_bad_rad	8-bit integer	None	Final cloud clearing pass cloud cleared radiances do not match clear guess - reject the IR retrieval
fcc_contrast1	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 1
fcc_contrast2	32-bit floating-point	None	Final cloud clearing contrast (units?) pass 2
bad_final	8-bit integer	None	Final retrieval failed
bad_final_cc	8-bit integer	None	final cloud clearing failed
bad_final_ir	8-bit integer	None	final IR retrieval failed
bad_final_surf	8-bit integer	None	final surface ret failed
bad_final_temp	8-bit integer	None	final temp ret failed
bad_final_h2o	8-bit integer	None	final water vapor ret failed
bad_final_o3	8-bit integer	None	final ozone ret failed
bad_final_cloud	8-bit integer	None	final cloud ret failed
bad_cc_cld_ret	8-bit integer	None	Cloud clearing and cloud ret are inconsistent
MW_IR_ret_differ	8-bit integer	None	Microwave and IR temperature retrieval differ too much - reject final IR retrieval
bad_MW_low_resid	8-bit integer	None	Microwave residuals in lower atmosphere too large - reject final IR retrieval
MW_low_atm_resid	32-bit floating-point	None	MW residual for lower atmosphere after final retrieval
final_AMSU_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_HSB_ret	8-bit integer	None	0 for success; 1 for did not converge;

			2 for residual too large; 3 for retrieval step not attempted
final_cloud_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_surf_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_temp_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_h2o_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_o3_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_ch4_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_co_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
final_co2_ret	8-bit integer	None	0 for success; 1 for did not converge; 2 for residual too large; 3 for retrieval step not attempted
bad_vis_rad	8-bit integer	None	Vis/NIR radiance out of range
bad_vis_cal	8-bit integer	None	Vis/NIR calibration data old or invalid
bad_vis_det_temp	8-bit integer	None	Vis/NIR Detector temperature out of range
bad_scan_hd_temp	8-bit integer	None	Scan Head Assembly temperature out of range
Initial_CC_score	32-bit floating-point	None	Indicator of how well the initial cloud-cleared radiances match radiances reconstructed from clear eigenvectors. (Unitless ratio; 0.33 is best possible, a 3X noise reduction; <0.8 for a very good match; <3.0 for a pretty good match; >10.0 indicates a major problem)
Initial_CC_subscores	32-bit floating-point	ScoresBand (= 10)	Sub-scores contributing to Initial_CC_score, by frequency band
MODIS_emis	32-bit floating-point	MODISEmisBand (= 6)	First guess emissivity from MODIS averaged over MOD11C3 0.05 degree (~5 km) pixels covering an area roughly corresponding to an AMSU FOV or 3x3 of AIRS FOVs.
MODIS_emis_dev	32-bit floating-point	MODISEmisBand (= 6)	Standard Deviation among the MOD11C3 elements used to determine MODIS_emis
MODIS_emis_spots	32-bit floating-point	MODISEmisBand (= 6) * AIRSTrack (= 3) * AIRSXTrack (= 3)	First guess emissivity from MODIS averaged over MOD11C3 0.05 degree (~5 km) pixels covering an area roughly corresponding to an AIRS FOV.
MODIS_emis_spots_dev	32-bit floating-	MODISEmisBand (= 6) * AIRSTrack (= 3) *	Standard Deviation among the MOD11C3 elements used to determine MODIS_emis

RetQAFlag	16-bit unsigned integer	None	Obsolete. Use species-specific Qual_Xxx instead. Retrieval QA flags. Bit 15: spare, set to zero.; Bit 14 (value 16384): Ozone retrieval is suspect or rejected. (see Qual_O3 for details); Bit 13 (value 8192): Water vapor retrieval is suspect or rejected. (see Qual_H2O for details); Bit 12 (value 4096): Top part of temperature profile quality check failed or not attempted. (above Press_mid_top_bndry mbar, indices nStd_mid_top_bndry and nSup_mid_top_bndry; see Qual_Temp_Profile_Top for details); Bit 11 (value 2048): Middle part of temperature profile quality check failed or not attempted. (between Press_bot_mid_bndry and Press_top_mid_bndry mbar, indices nStd_bot_mid_bndry, nSup_bot_mid_bndry, nStd_bot_mid_bndry, and nSup_bot_mid_bndry; see Qual_Temp_Profile_Mid for details); Bit 10 (value 1024): Bottom part of temperature profile quality check failed or not attempted. (below Press_bot_mid_bndry mbar, indices nStd_bot_mid_bndry and nSup_bot_mid_bndry; see Qual_Temp_Profile_Bot for details); Bit 9 (value 512): Surface retrieval is suspect or rejected. (see Qual_Surf for details); Bit 8 (value 256): This record type not yet validated. For v4.0 all regions North of Latitude 50.0 degrees or South of Latitude -50.0 degrees will be flagged.; Bits 6-7: spare, set to zero; Bit 5 (value 32): Cloud retrieval rejected or not attempted; Bit 4 (value 16): Final retrieval rejected or not attempted; Bit 3 (value 8): Final Cloud Clearing rejected or not attempted; Bit 2 (value 4): Regression First Retrieval rejected or not attempted; Bit 1 (value 2): Initial Cloud Clearing rejected or not attempted; Bit 0 (LSB, value 1): Startup retrieval (MW-Only and/or cloudy regression depending on Startup) rejected or not attempted

3.7 Special AIRS Types

AIRS works around the lack of support for records in HDF-EOS Swath by grouping related fields into pseudo-records. HDF-EOS fieldnames are generated by concatenating the pseudo-record name with the subfield name, putting a "." character in between. Since these record types do not exist at the HDF-EOS swath level, reading subfield "flags" of AIRS field "startup_tair_range" involves reading HDF-EOS Swath field “startup_tair_range.flags".

Profile range check: This type provides information about how many levels of a profile are how far out of the bounds over which the algorithm is validated.

Field Name	Type	Explanation
flags	8-bit unsigned integer	bit 7: unused, set to zero; bit 6 (value 64): Invalid input; bit 5 (value 32): high input value error; bit 4 (value 16): low input value error; bit 3 (value 8): high input value warning;

		bit 2 (value 4): low input value warning; bit 1 (value 2): input value high, but not enough for warning; bit 0 (LSB, value 1): input value low, but not enough for warning
num_hi_50	8-bit unsigned integer	Number of levels at least 50% above valid range
num_lo_50	8-bit unsigned integer	Number of levels at least 50% below valid range
num_hi_25	8-bit unsigned integer	Number of levels at least 25% but not more than 50% above valid range
num_lo_25	8-bit unsigned integer	Number of levels at least 25% but not more than 50% below valid range
num_hi_10	8-bit unsigned integer	Number of levels at least 10% but not more than 25% above valid range
num_lo_10	8-bit unsigned integer	Number of levels at least 10% but not more than 25% below valid range
num_bad	8-bit unsigned integer	Number of invalid levels
worst_case	32-bit floating-point	Percentage out of range (logarithmic) of worst case.; Positive when worst case is above validated range; negative when worst case is below validated range; zero when all elements are in range.

4. Options for Reading Data

The HDF Group provides various utilities for viewing the contents of HDF files and extracting the raster, binary, or ASCII objects (see http://hdf.ncsa.uiuc.edu/products/index.html)

4.1 Command-line utilities

4.1.1 read_hdf

The read_hdf tool is a command-line utility developed by GES DISC. It allows user to browse the file structure and display data values if desired. The source code is written in C language and can be obtained from: ftp://disc1.gsfc.nasa.gov/software/aura/read_hdf

Command line syntax:

```
read_hdf [-l] | [[-i | -d] [-a <output> | -b <base>.*.bin ]]  filename

Options/Arguments:

   [-i] -- run in interactive mode (default), or
   [-l] -- list a tree of file objects, or
   [-d] -- dump all HDF object types (no filtering)
   [-a <output>] -- ASCII output file name (default is <filename>.txt)
   [-b <base>] -- base binary output file name (default is <filename>)
                  creates two files per HDF object:
                  <base>.*.met for metadata, and <base>.*.bin for binary data
                  (default output to stdout)
   filename -- name of the input HDF file
```

4.1.2 ncdump

The **ncdump** dumps HDF to ASCII format

```
ncdump [-c|-h] [-v ...] [[-b|-f] [c|f]] [-l len] [-n name] [-d n[,n]]
filename

Options/Arguments:
  [-c]               Coordinate variable data and header information
  [-h]               Header information only, no data
  [-v var1[,...]]    Data for variable(s) <var1>,... only
  [-b [c|f]]         Brief annotations for C or Fortran indices in data
  [-f [c|f]]         Full annotations for C or Fortran indices in data
  [-l len]           Line length maximum in data section (default 80)
  [-n name]          Name for netCDF (default derived from file name)
  [-d n[,n]]         Approximate floating-point values with less precision
  filename           File name of input netCDF file

e.g.
     ncdump <inputfilename.hdf>
```

```
        dumps the entire contents of an HDF file to ASCII format
ncdump –v <variable name> <inputfilename.hdf>
        dump one data variable from the HDF file to ASCII format
ncdump -h <inputfilename.hdf> | more
        dump only the metadata information to the screen
ncdump -h <inputfilename.hdf> > ascii.out
        dump this metadata information to an output file named ascii.out
```

Note: the ncdump tool will only display variables whose ranks are great than 1. In other words, you will not see one dimensional vectors such as *satheight* using this tool.

The ncdump -H command provides instructions for using ncdump. Comprehensive yet simple instructions for extracting data and metadata from HDF files are given below. The following website (http://nsidc.org/data/hdfeos/hdf_to_ascii.html) provides step-by-step instructions on how to download, install and execute ncdump commands.

4.1.3 hdp

hdp is a command line utility designed for quick display of contents and data of HDF objects. It can list the contents of hdf files at various levels with different details. It can also dump the data of one or more specific objects in the file.

```
Usage: hdp [-H] command [command options] <filelist>
          -H  Display usage information about the specified command.
              If no command is specified, -H lists all commands.

          Commands:
              list       lists contents of files in <filelist>
              dumpsds    displays data of SDSs in <filelist>
              dumpvd     displays data of vdatas in <filelist>.
              dumpvg     displays data of vgroups in <filelist>.
              dumprig    displays data of RIs in <filelist>.
              dumpgr     displays data of RIs in <filelist>.
```

Detailed information on how to download, install and execute **hdp** command is found at http://nsidc.org/data/hdfeos/hdf_to_binary.html

4.2 GUI tools

The HDFView (http://hdf.ncsa.uiuc.edu/hdf-java-html/hdfview/) is a visual tool for browsing and editing NCSA HDF4 and HDF5 files and is available for various platforms (Windows 98/NT/2000/XP, Solaris, Linux, AIX, Irix 6.5, MacOSX). Using HDFView, you can:

(1) view a file hierarchy in a tree structure
(2) create new file, add or delete groups and datasets
(3) view and modify the content of a dataset
(4) add, delete and modify attributes
(5) replace I/O and GUI components such as table view, image view and metadata view

Users, especially **those who are not familiar with Unix/Linux environment** are strongly encouraged to use HDFView for a quick access to data contents.
There is also an add-on plug-in for handling HDFEOS data specifically, which you can download from: http://opensource.gsfc.nasa.gov/projects/hdf/hdf.php

4.3 Read software in IDL, MATLAB, C, and Fortran

AIRS science team provides reader software in IDL, MATLAB, C and FORTRAN programming language. You can download them from GES DISC web site:

(1) IDL / MATLAB suite along with sample HDFEOS data files (http://disc.gsfc.nasa.gov/AIRS/documentation/v5_docs/AIRS_V5_Release_User_Docs/IDL_MATLAB_READERS.tar.gz)
(2) FORTRAN / C suite along with sample HDFEOS data files (http://disc.gsfc.nasa.gov/AIRS/documentation/v5_docs/AIRS_V5_Release_User_Docs/FORTRAN_C_READERS.tar.gz)

If you want to program yourself, the programming model for accessing a swath data set through the swath (SW) interface is as follows:

(1) Open the file and obtain a file id from a file name.
(2) Open a swath data set by obtaining a swath id from a swath name.
(3) Perform desired operations on the data set.
(4) Close the swath data set by disposing of the swath id.
(5) Terminate swath access to the file by disposing of the file id.

A complete list of swath interface routines is summarized in the next two pages. To read an HDFEOS data file, access, basic I/O and inquiry routines are of particular interest.

Summary of HDF-EOS Swath Interface

Category	Routine Name		Description
	C	FORTRAN	
Access	SWopen	swopen	opens or creates HDF file in order to create, read, or write a swath
	SWcreate	swcreate	creates a swath within the file
	SWattach	swattach	attaches to an existing swath within the file
	SWdetach	swdetach	detaches from swath interface
	SWclose	swclose	closes file
Definition	SWdefdim	swdefdim	defines a new dimension within the swath
	SWdefdimmap	swdefmap	defines the mapping between the geolocation and data dimensions
	SWdefidxmap	swdefimap	defines a non-regular mapping between the geolocation and data dimension
	SWdefgeofield	swdefgfld	defines a new geolocation field within the swath
	SWdefdatafield	swdefdfld	defines a new data field within the swath
	SWdefprofile		defines the profile data structure within the swath
	SWdefcomp	swdefcomp	defines a field compression scheme
	SWwritegeometa	swwrgmeta	writes field metadata for an existing swath geolocation field
	SWwritedatameta	swwrdmeta	writes field metadata for an existing swath data field
Basic I/O	SWwritefield	swwrfld	writes data to a swath field
	SWreadfield	swrdfld	reads data from a swath field.
	SWwriteprofile		writes data to the profile
	SWreadprofile		reads data from the profile
	SWwriteattr	swwrattr	writes/updates attribute in a swath
	SWreadattr	swrdattr	reads attribute from a swath
	SWwritegrpattr	swwrgattr	writes/updates attribute as a swath
	SWreadgrpattr	swrdgattr	reads group attribute from a swath
	SWwritelocattr	swwrlattr	writes/updates local attribute in a swath
	SWreadlocattr	swrdlattr	reads local attribute from a swath
	SWsetfillvalue	swsetfill	sets fill value for the specified field
	SWgetfillvalue	swgetfill	retrieves fill value for the specified field
Inquiry	SWinqdims	swinqdims	retrieves information about dimensions defined in swath
	SWinqmaps	swinqmaps	retrieves information about the geolocation relations defined
	SWinqidxmaps	swinqimaps	retrieves information about the indexed geolocation/data mappings defined
	SWinqgeofields	swinqgflds	retrieves information about the geolocation fields defined
	SWinqdatafields	swinqdflds	retrieves information about the data fields defined
	SWinqattrs	swinqattrs	retrieves number and names of attributes defined
	SWinqgrpattrs	swinqgattrs	retrieves number and names of group attributes defined
	SWinqlocattrs	swinqlattrs	retrieves number and names of local attributes defined
	SWnentries	swnentries	returns number of entries and descriptive string buffer size for a specified entity
	SWdiminfo	swdiminfo	retrieve size of specified dimension
	SWgrpattrinfo	swgattrinfo	retrieves information about swath group attributes
	SWlocattrinfo	swlattrinfo	returns information about swath local attributes

Summary of HDF-EOS Swath Interface

Category	Routine Name		Description
	C	FORTRAN	
	SWmapinfo	swmapinfo	retrieve offset and increment of specified geolocation mapping
	SWidxmapinfo	swimapinfo	retrieve offset and increment of specified geolocation mapping
	SWattrinfo	swattrinfo	returns information about swath attributes
	SWfieldinfo	swfldinfo	retrieve information about a specific geolocation or data field
	SWcompinfo	swcompinfo	retrieve compression information about a field
	SWinqswath	swinqswath	retrieves number and names of swaths in file
	SWregionindex	swregidx	returns information about the swath region ID
	SWupdateidxmap	swupimap	update map index for a specified region
Subset	SWgeomapinfo	swgmapinfo	retrieves type of dimension mapping when first dimension is geodim
	SWdefboxregion	swdefboxreg	define region of interest by latitude/longitude
	SWregioninfo	swreginfo	returns information about defined region
	SWextractregion	swextreg	read a region of interest from a field
	SWdeftimeperiod	swdeftmeper	define a time period of interest
	SWperiodinfo	swperinfo	retuns information about a defined time period
	SWextractperiod	swextper	extract a defined time period
	SWdefvrtregion	swdefvrtreg	define a region of interest by vertical field
	SWdupregion	swdupreg	duplicate a region or time period
	SWdefscanregion		define region of interest based on range of scans

5. Data Services

File Subsetting Services

Users can limit number of files for download by specifying appropriate spatial and temporal constraints in search engines like Mirador (http://mirador.gsfc.nasa.gov). The total download size can be further reduced by choosing a subset of variables, channels within each file through the subsetting service. AIRS file subsetting service is provided as a part of the data ordering process through the Mirador search engine. The table below shows the available subsetting options for AIRS Level-1B and Level-2 products.
(http://disc.sci.gsfc.nasa.gov/AIRS/data_access.shtml)

Product Name	Variable	Channel	Spatial
AIRIBRAD		√	
AIRABRAD		√	
AIRVBRAD		√	
AIRXBCAL	√	√	√
AIRX2RET / AIRH2RET	√		
AIRH2CCF/AIRI2CCF/AIRS2CCF		√	
AIRX2SUP / AIRH2SUP/ AIRS2SUP	√		

Direct data access via FTP available at

server: airspar1u.ecs.nasa.gov
directory: /data/s4pa/Aqua_AIRS_Level2/

For NRT product,

server: airscal1u.ecs.nasa.gov
diretory: /data/s4pa/Aqua_AIRS_NearRealTime

6. Data Interpretation and Screening

6.1 Quality screening and interpretation

Level 2 Quality Indicators:

The AIRS Level 2 Product (can be applied to support products) contains many retrieved parameters, and each has an associated quality indicator which the researcher should use to filter and subset the specific geophysical parameter of interest. The possible values are:

Quality = 0 => "BEST"
Data products individually meet our accuracy requirements and may be used for data assimilation and statistical climate studies.
Quality = 1 => "GOOD"
Data may be used for statistical climate studies, as they meet the accuracy requirements only when temporally and/or spatially averaged. Note that relying solely on quality = 0 cases when generating monthly mean fields may result in significant sampling biases.
Quality = 2 => "DO NOT USE"
While we do not recommend use of any quality = 2 data, we recognize that it may be the only data available in the vicinity of hurricanes and storm fronts. Users should carefully check the error estimates on the individual soundings and proceed with great caution if they contemplate making use of these data.

Recommendations for use of the quality control flags are found in "AIRS/AMSU/HSB Version 5 Level-2 Quality Control and Error Estimation"

LEVEL 2 QUALITY INDICATORS
Introduction
Level 2 MW-Only Retrieval Quality Indicators
MW-Only Temperature Profile Quality Indicators
MW-Only Moisture Profile and Cloud Liquid Water Quality Indicator
Level 2 Combined IR/MW Retrieval Quality Indicators
Temperature Profile Quality Indicators
Quality Indicators for Other Retrieved Parameters
Special Note for Users of Moisture Profile Products

COMBINED IR/MW RETRIEVAL ERROR ESTIMATION
HOW COMBINED IR/MW QUALITY CONTROL IS SET UPON COMPLETION OF FINAL RETRIEVAL
Preliminary Determinations
Qual_Temp_Profile_Top
Qual_Temp_Profile_Mid
Qual_Temp_Profile_Bot
Qual_Surf
Qual_H2O
Qual_O3
Qual_CO

Qual_CH4
Qual_CO2
Qual_Cloud_OLR
Qual_clrolr
Qual_CC_Rad
Qual_Precip_Est
Qual_Clim_Ind

6.2 Pointers/References to articles discussing product validity and quality

Report on the status of V5 calibration and validation is provided in the document:
V5_CalVal_Status_Summary.pdf
(http://disc.gsfc.nasa.gov/AIRS/documentation/v5_docs/AIRS_V5_Release_User_Docs/V5_CalVal_Status_Summary.pdf)

The product-specific quality indicators and error estimates discussed in detail in the two documents:
V5_L2_Quality_Control_and_Error_Estimation.pdf
(http://disc.gsfc.nasa.gov/AIRS/documentation/v5_docs/AIRS_V5_Release_User_Docs/V5_L2_Quality_Control_and_Error_Estimation.pdf)

V5_L2_Standard_Product_QuickStart.pdf
(http://disc.gsfc.nasa.gov/AIRS/documentation/v5_docs/AIRS_V5_Release_User_Docs/V5_L2_Standard_Product_QuickStart.pdf)

7. More Information

7.1 Web resources for AIRS data users:

NASA/JPL:

- AIRS Project Web Site: http://airs.jpl.nasa.gov/
- Ask AIRS Science Questions: http://airs.jpl.nasa.gov/AskAirs/
-

NASA/GSFC:

- AIRS Data Support Main Page: http://disc.sci.gsfc.nasa.gov/AIRS/
- AIRS Data Access: http://disc.sci.gsfc.nasa.gov/AIRS/data_access.shtml
- AIRS Documentation: http://disc.sci.gsfc.nasa.gov/AIRS/documentation.shtml
- AIRS Products: http://disc.sci.gsfc.nasa.gov/AIRS/data_products.shtml

Data can also be obtained from **Giovanni** (online visualization and analysis tool): http://acdisc.sci.gsfc.nasa.gov/Giovanni/airs/

7.2 Point of Contact

URL	http://disc.gsfc.nasa.gov/	
Contact	Name	GES DISC HELP DESK SUPPORT GROUP
	Email	gsfc-help-disc@lists.nasa.gov
	Phone	301-614-5224
	Fax	301-614-5268
	Address	Goddard Earth Sciences Data and Information Services Center, Code 610.2 NASA Goddard Space Flight Center, Greenbelt, MD, 20771, USA

8. Acronyms

ADPUPA Automatic Data Processing Upper Air (radiosonde reports)
ADPUPA Automatic Data Processing Upper Air (radiosonde reports)
AIRS Atmospheric infraRed Sounder
AMSU Advanced Microwave Sounding Unit
DAAC Distributed Active Archive Center
DISC Data and Information Services Center
DN Data Number
ECMWF European Centre for Medium Range Weather Forecasts (UK)
ECS EOSDIS Core System
EDOS Earth Observing System Data and Operations System
EOS Earth Observing System
EOSDIS Earth Observing System Data and Information System
ESDT Earth Science Data Type
EU Engineering Unit
FOV Field of View
GDAAC Goddard Space Flight Center Distributed Active Archive Center
GES Goddard Earth Sciences
GSFC Goddard Space Flight Center
HDF Hierarchical Data Format
HSB Humidity Sounder for Brazil
L1A Level 1A Data
L1B Level 1B Data
L2 Level 2 Data
L3 Level 3 Data
LGID Local Granule IDentification
MW Microwave
NCEP National Centers for Environmental Prediction
NESDIS National Environmental Satellite, Data and Information Service
NIR Near Infrared
NOAA National Oceanic and Atmospheric Administration
PGE Product Generation Executive
PGS Product Generation System
PREPQC NCEP quality controlled final observation data
QA Quality Assessment
RTA Radiative Transfer Algorithm
SPS Science Processing System
URL Universal Reference Link
VIS Visible
WMO World Meteorological Organization